



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

UC-NRLF



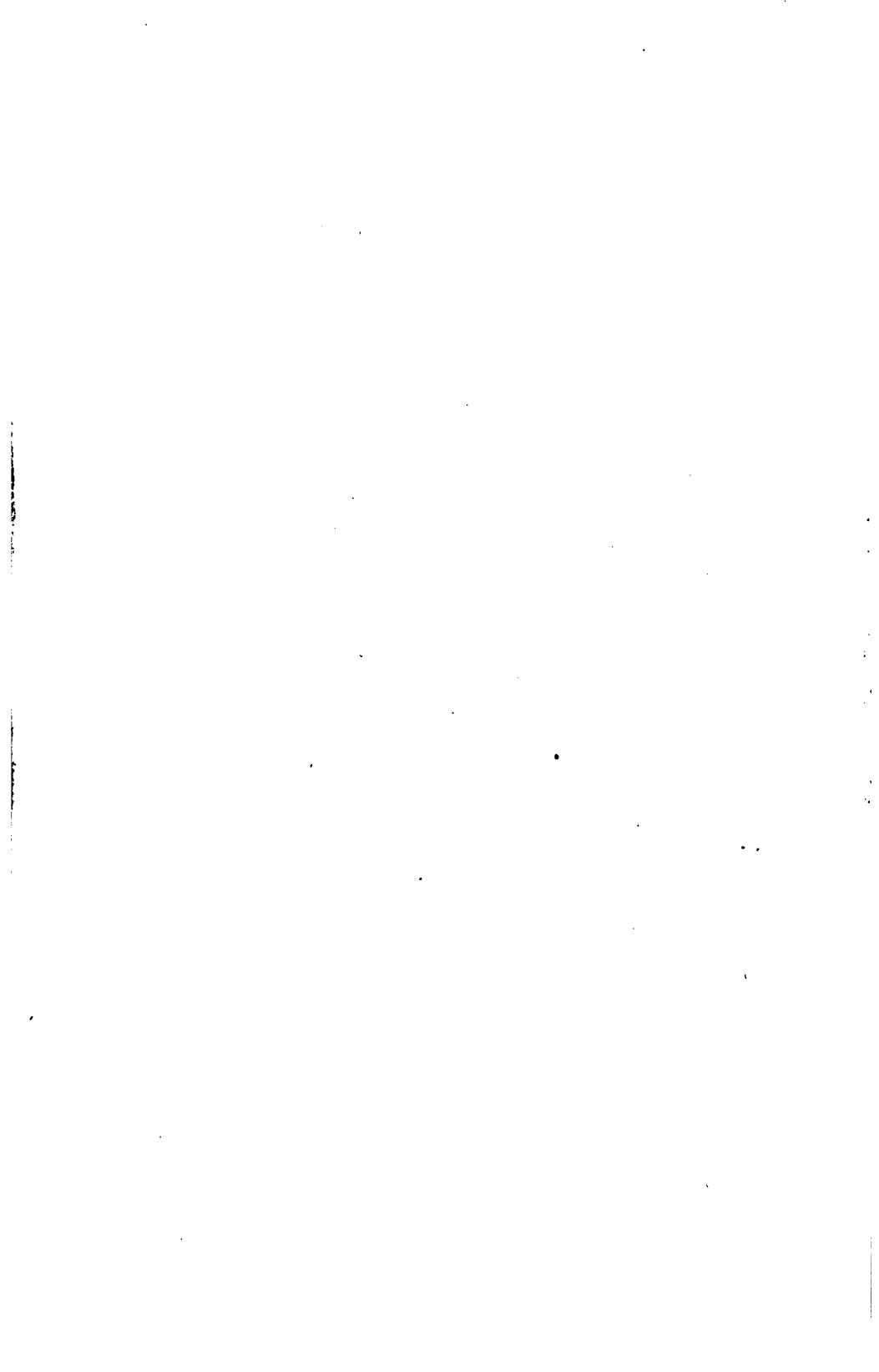
QB 17 090

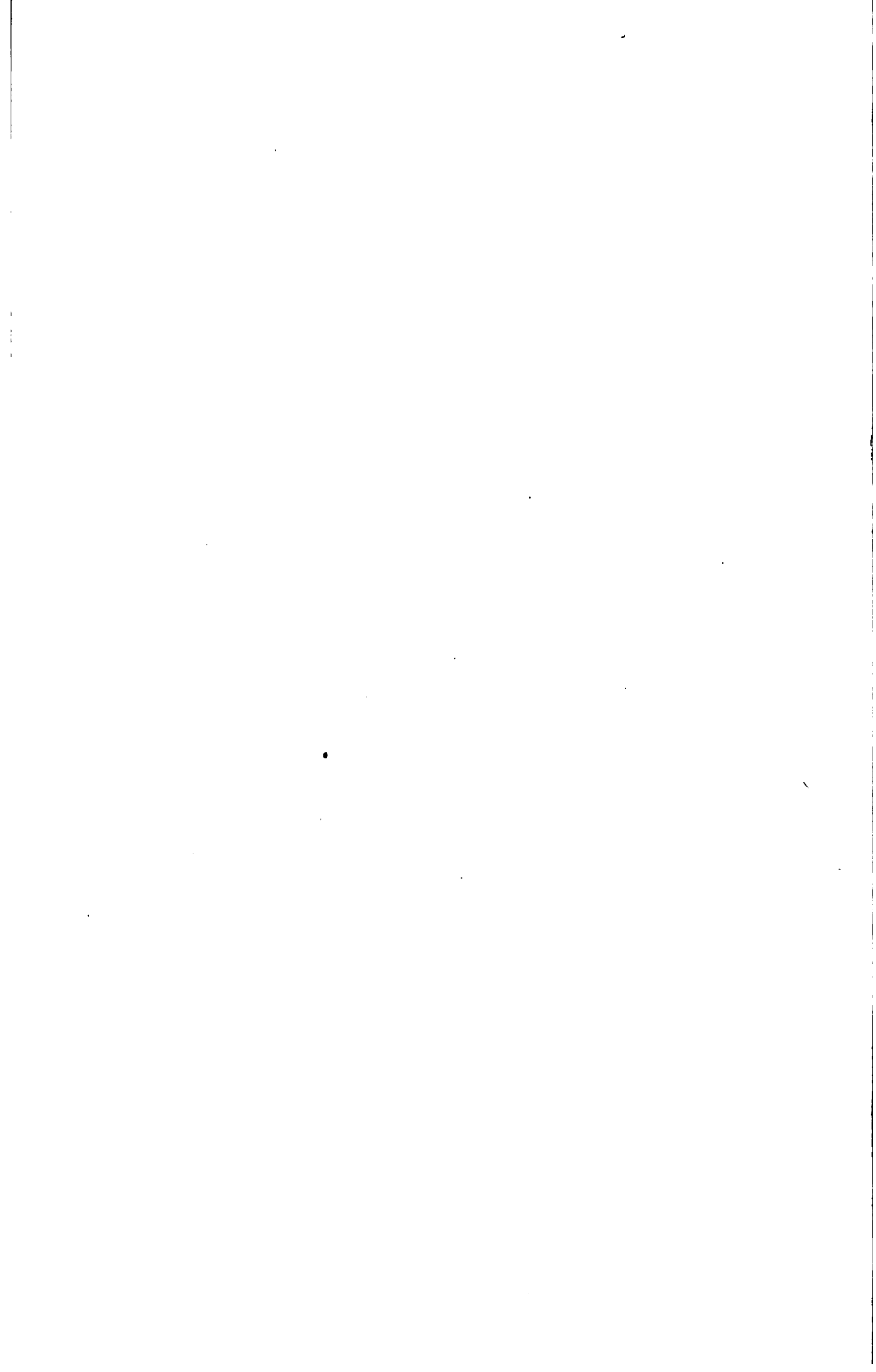
LIBRARY
OF THE
UNIVERSITY OF CALIFORNIA.

Received *Mar.* , 189*3*

Accessions No. *50871* . Class No. *2*.







SYLLABUS

—OF A—

COURSE IN PEDAGOGY

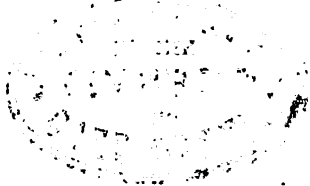
EMBRACING EDUCATIONAL PSYCHOLOGY, METHODS OF TEACHING,
SCHOOL ECONOMY, AND HISTORY OF EDUCATION.

—BY—
EDWARD BROOKS,

Superintendent of Public Schools, Philadelphia.

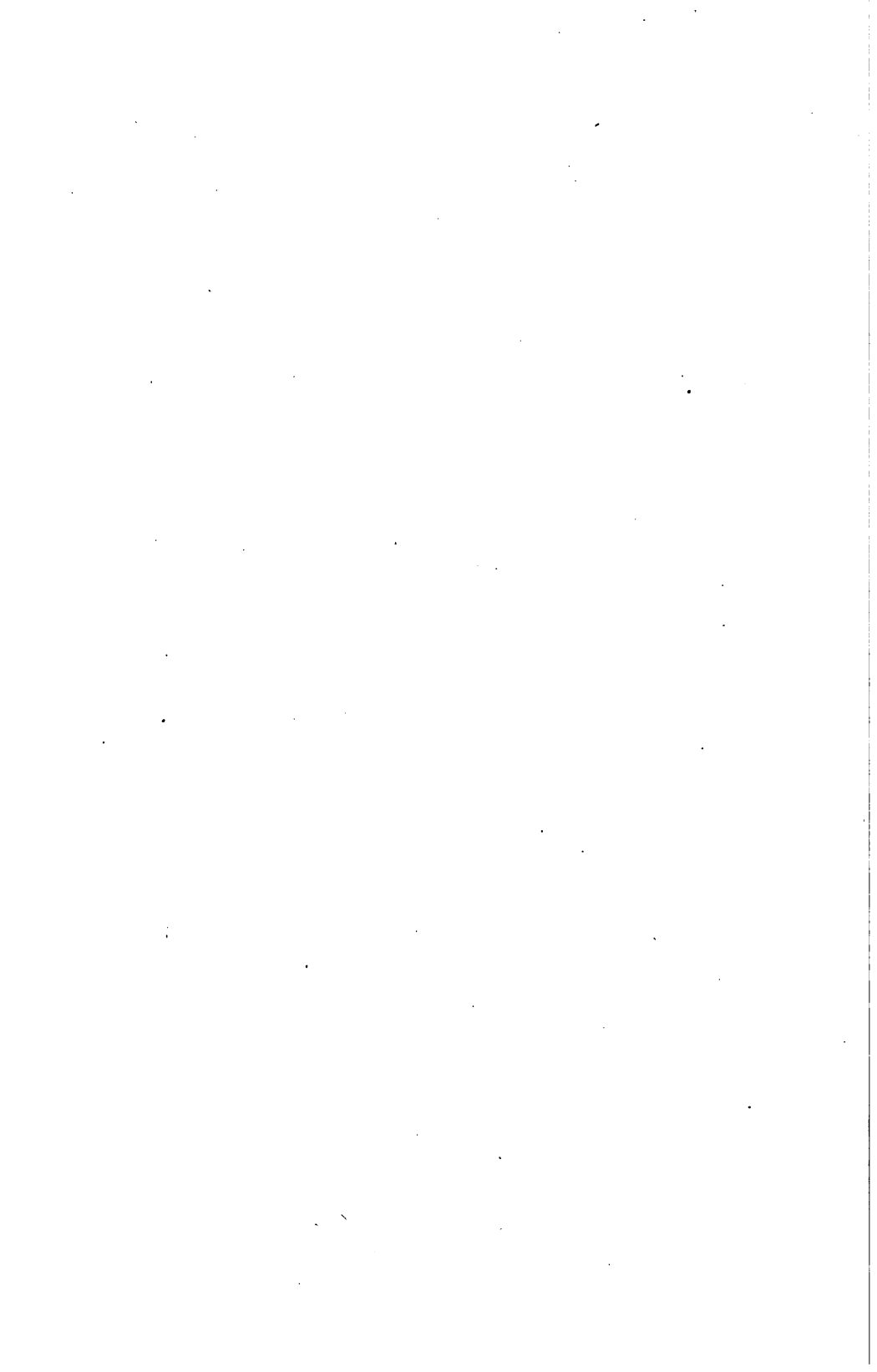
“The object of education is to give to the body and the soul all the beauty and perfection of which they are capable.”—*Plato.*

“The object of education is to prepare for complete living.”—*Herbert Spencer.*



PHILADELPHIA:
BURK & McFETRIDGE, 306 AND 308 CHESTNUT ST.

1892.



SYLLABUS

—OF A—

COURSE IN PEDAGOGY

EMBRACING EDUCATIONAL PSYCHOLOGY, METHODS OF TEACHING,
SCHOOL ECONOMY, AND HISTORY OF EDUCATION.

—BY—

EDWARD BROOKS,

"
Superintendent of Public Schools, Philadelphia.

"The object of education is to give to the body and the soul all the beauty and perfection of which they are capable."—*Plato.*

"The object of education is to prepare for complete living."—*Herbert Spencer.*

PHILADELPHIA:

BURK & McFETRIDGE, 306 AND 308 CHESTNUT ST.

1892.



LB1025
B7

50871

PREFACE.

This syllabus of a general course in Pedagogy has been prepared for a two-fold purpose. First, it is designed as a basis of lectures by the Superintendent to the teachers of Philadelphia on the science and art of Teaching. Second, it is also intended as a suggestion or a guide to such teachers of the city as may desire to continue their educational reading or who may wish to make a more thorough study of Pedagogy than they have hitherto done.

It is to be understood that it is merely a syllabus, though a comprehensive one, and aims to suggest only the leading ideas of pedagogical thought and practice. Details are to be supplied and variations made by the individual student as may be thought desirable. While it is believed that the principles presented embrace all the leading ideas of the great thinkers on educational subjects, from the earliest times to the present day, these are not to be regarded as exhaustive of the subject, but merely suggestive of general lines of thought upon the topics considered. Teachers will remember also that many principles, no matter how broad or comprehensive, will need judicious modification in order to adapt them to the various cases that arise in the actual work of the school-room. It is suggested that the principles given be carefully scrutinized and criticised by those who may examine them, and especially by those who may be guided in their studies by this syllabus. Every professionally educated teacher should have in his mind some such outline of the theory and practice of teaching as is here presented; and it is hoped that these outlines may be at least suggestive of a scheme of educational doctrine worthy of the claim of the possibility of a *Profession of Teaching*.

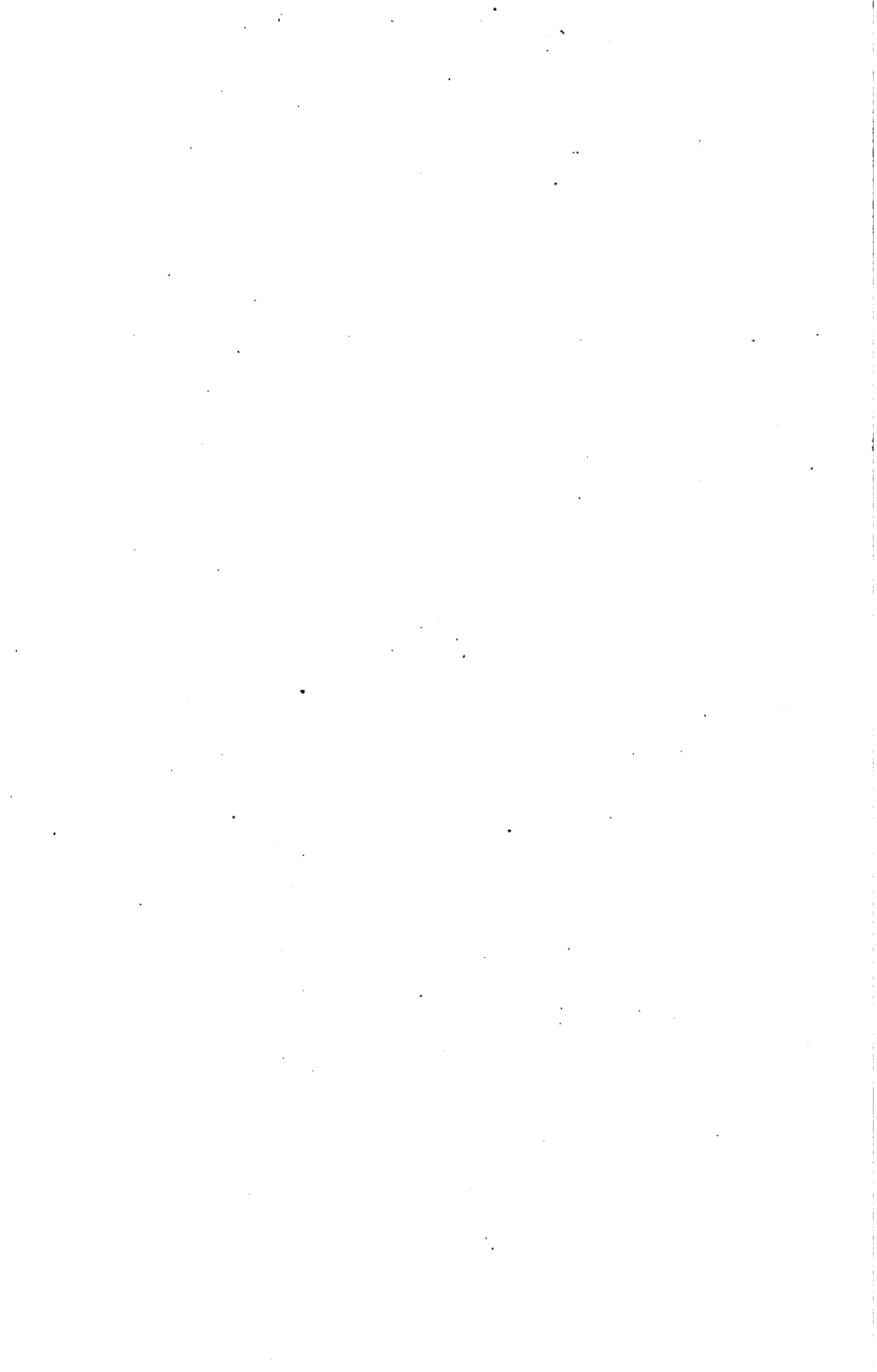
LIBRARY
OF THE
UNIVERSITY OF CALIFORNIA.

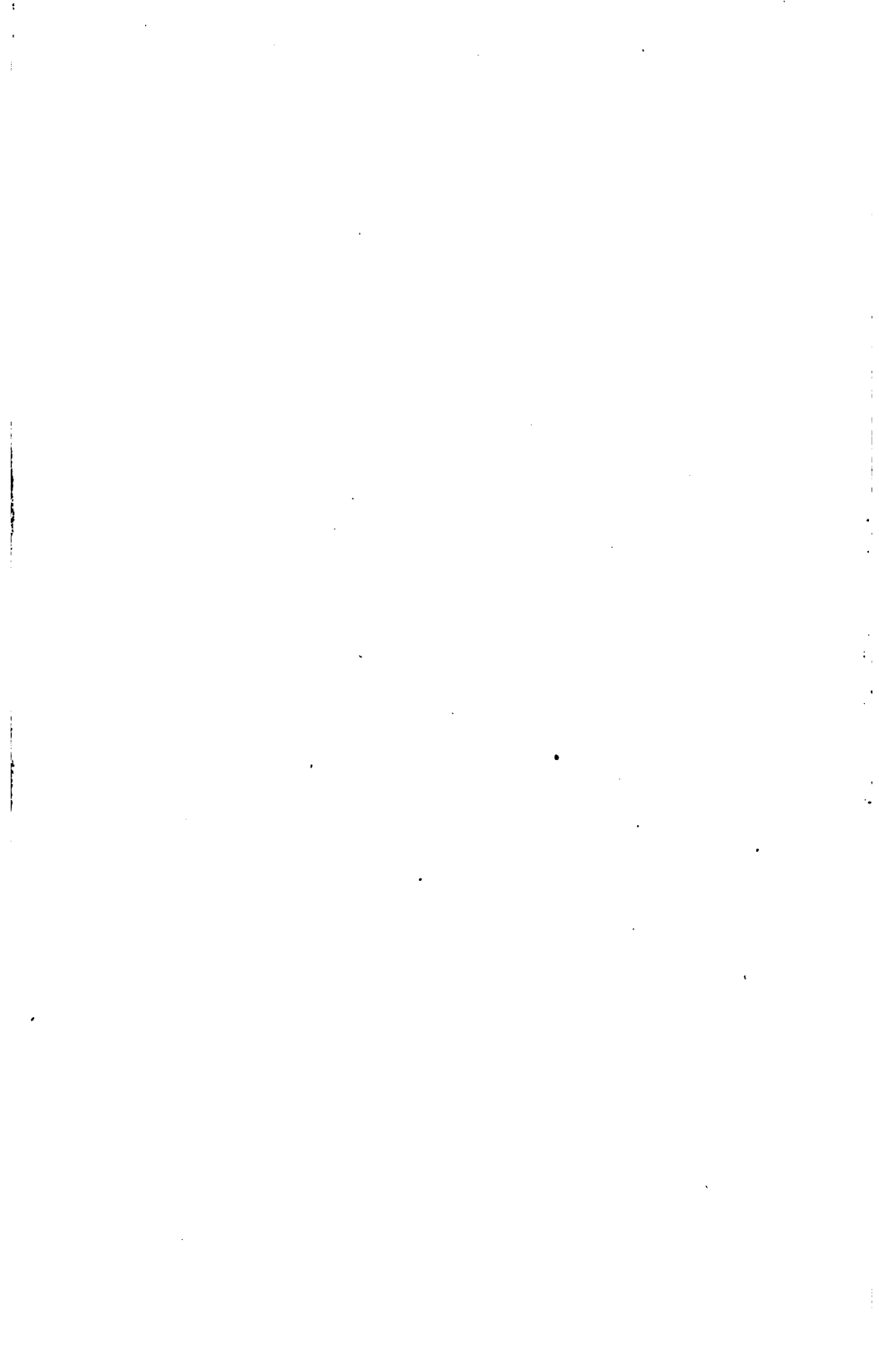
Received *Mar.* , 189*3*

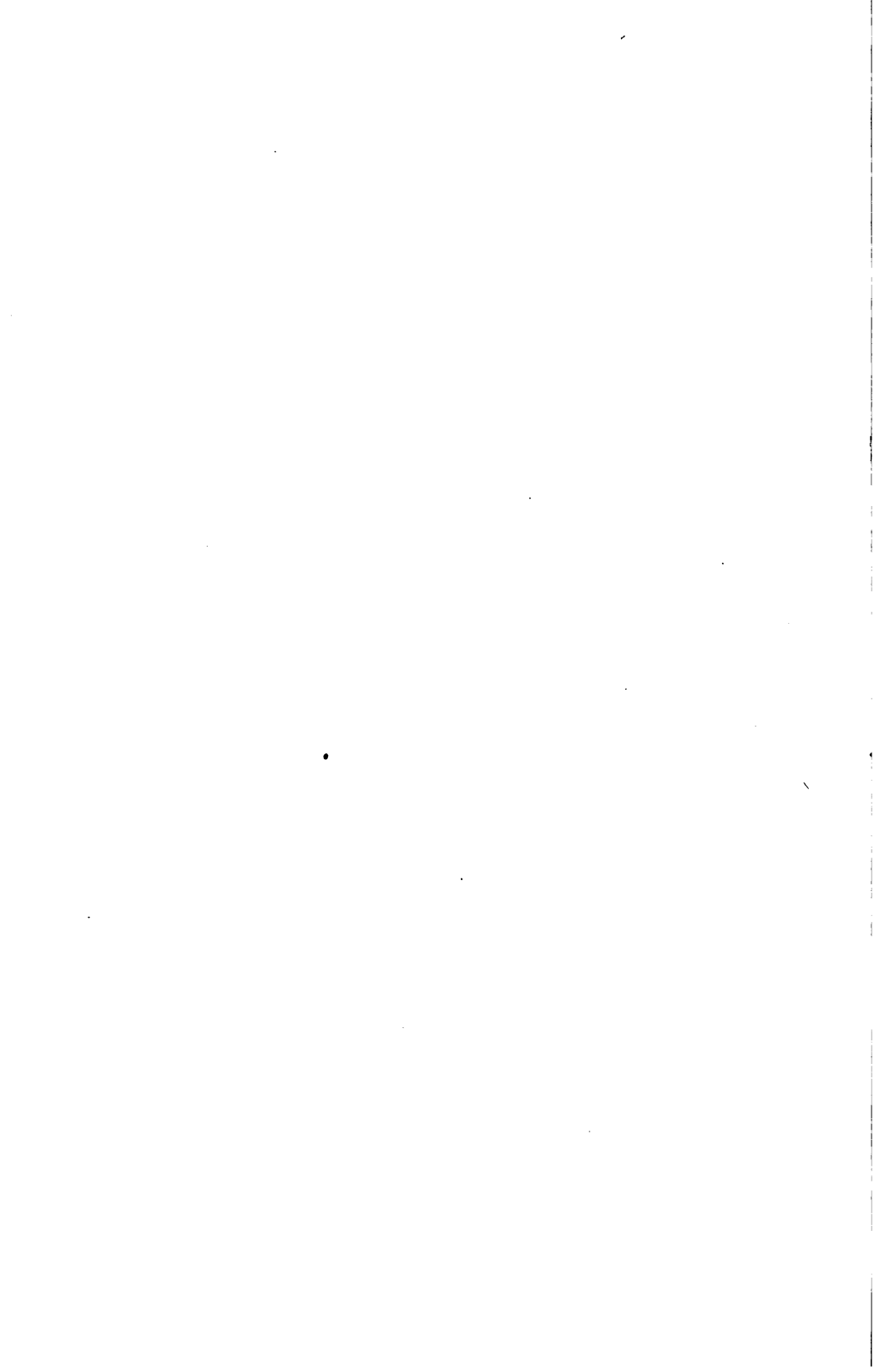
Accessions No. *50871* . Class No. .











SYLLABUS

—OF A—

COURSE IN PEDAGOGY

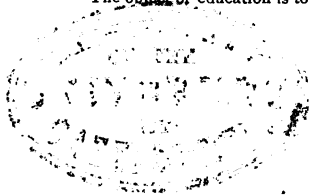
EMBRACING EDUCATIONAL PSYCHOLOGY, METHODS OF TEACHING,
SCHOOL ECONOMY, AND HISTORY OF EDUCATION.

—BY—
EDWARD BROOKS,

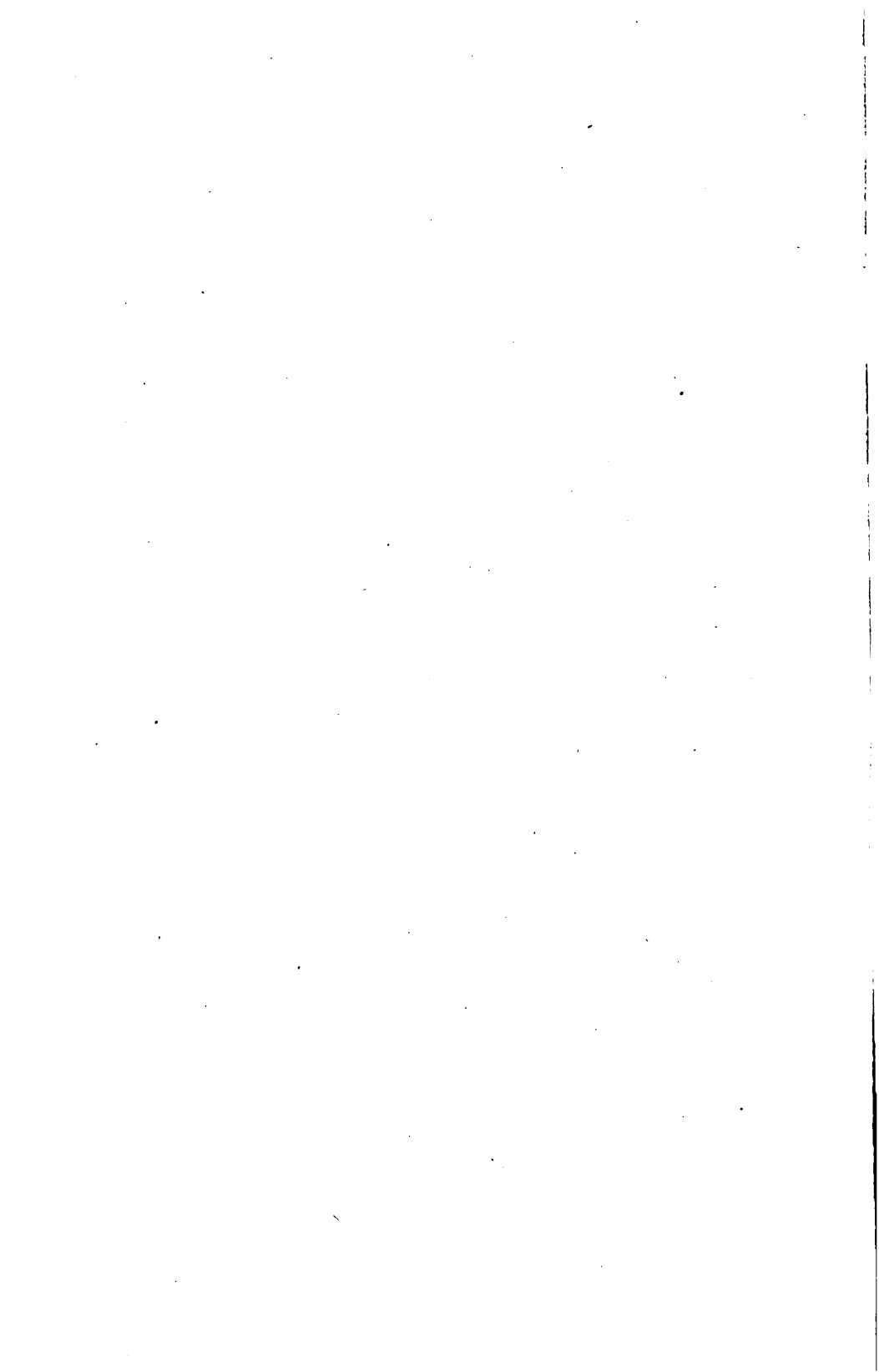
Superintendent of Public Schools, Philadelphia.

“The object of education is to give to the body and the soul all the beauty and perfection of which they are capable.”—*Plato.*

“The object of education is to prepare for complete living.”—*Herbert Spencer.*



PHILADELPHIA:
BURK & McFETRIDGE, 306 AND 308 CHESTNUT ST.
1892.



SYLLABUS

—OF A—

COURSE IN PEDAGOGY

EMBRACING EDUCATIONAL PSYCHOLOGY, METHODS OF TEACHING,
SCHOOL ECONOMY, AND HISTORY OF EDUCATION.

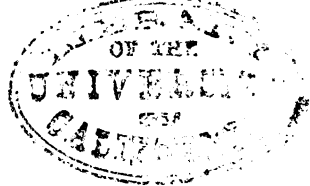
—BY—

EDWARD BROOKS,

Superintendent of Public Schools, Philadelphia.

"The object of education is to give to the body and the soul all the beauty and perfection of which they are capable."—*Plato.*

"The object of education is to prepare for complete living."—*Herbert Spencer.*



PHILADELPHIA:

BURK & McFETRIDGE, 306 AND 308 CHESTNUT ST.

1892.

2. Methods of cultivating the Memory :—Exercise ; clear conceptions ; attention ; interest ; repetition ; association ; special artifices ;—verse—key-words—sentences ; systems of mnemonics.

3. Application to Teaching :—In orthography—In geography—In history—In literature—In natural history—In arithmetic—In physiology, etc.

4. The Memory in education :—Educational value of the memory—The memory studies—Misuse of the memory in teaching—Rote learning—Words without ideas—Cramming, etc.

V. THE NATURE AND CULTURE OF THE IMAGINATION.

I. The Nature of the Imagination.

1. Its general nature defined and illustrated. Its relation to perception. Its relation to memory. Materials used in its operations.

2. Its Products :—new combinations ; new creations ; their relation and difference.

3. Its Forms :—phantasy ; fancy ; imagination proper.

4. Its Laws :—Involuntary ; voluntary ; suggestion ; spontaneous ; sensible forms, etc.

5. Its Limits :—By space ; by matter ; by time ; by mind.

6. Its Sphere of operations :—Vary the old ; combine the old into new forms ; create the new,—objects, forms, events, characters, etc.

II. The Culture of the Imagination.

1. Value of the culture of Imagination :—To thought ; To science ; To poetry ; To art ; To oratory ; To character.

2. Methods of cultivating the Imagination :—By exercise; study of nature; study of art; study of literature; forming new combinations; creating ideal productions.

3. Application in Teaching :—In orthography—In reading—In geography—In literature—In history—In geometry—In drawing—In modeling—In music, etc.

4. Its relations :—To science—To fiction—To poetry—To painting—To sculpture—Idealism and realism in art.

VI. THE UNDERSTANDING OR THOUGHT-POWER.

1. The Understanding defined and illustrated: names of the faculty; its products; its operations (analysis and synthesis); its basis (comparison).

2. Forms of activity of the Understanding :—Abstraction—Conception—Judgment—Reasoning.

3. Culture of the Understanding :—Its value—Its neglect—Time for culture—The thought-studies of the school—Each faculty to be considered separately.

VII. THE NATURE AND CULTURE OF ABSTRACTION.

I. The Nature of Abstraction.

1. Its nature defined and illustrated. Positive and negative. The power questioned. Arguments for the power. Other views,—limited view, wider view. General remarks.

2. Products of Abstraction :—Abstracts; pure abstracts are particular; general abstract ideas.

II. The Culture of Abstraction.

1. The importance of correct culture :—Value of the power of abstract thought—The concrete before the abstract—Errors of the old education—Dangers in the new education.

2. Methods of cultivating Abstraction :—By spontaneous activity; drill on abstract qualities; study of the abstract sciences; not take a child to the abstract too early.

VIII. THE NATURE AND CULTURE OF CONCEPTION.

I. The Nature of Conception.

1. The general nature defined and illustrated. Nature of the general idea. The term generalization. The term conception.

2. The process of Conception :—The basis of the process; Forming the concept (the three steps); Naming the concept; Forming higher concepts; The three steps not always formal; A synthetic process; An ascending process.

3. The nature of the Concept :—Definition of the concept; Not an image; Relation to a percept; Concrete and abstract; Broad and narrow; Higher and lower; Relation of concepts; Content and extent; Extension and intension; Distribution of concepts.

4. Qualities of Concepts :—Clear and obscure; Distinct and confused; Adequate and inadequate; Notative and symbolical; Absolute and relative; Contrary and contradictory; Positive and negative.

5. Unfolding conceptions :—Logical division; logical analysis; logical definition.

6. Existence of general ideas :—Their existence questioned; nominalism and its arguments; conceptionalism and its arguments; Bain's discussion of the subject; reply to Bain.

7. Classification :—Nature of classification; scientific classification; early attempts and progress of classification; scientific genius; classes in nature.

II. The Culture of Conception.

1. Value of Conception:—Basis of thought; Basis of language; Basis of science.

2. Methods of cultivating Conception:—In studies; By logical analysis; By logical division; By logical definition.

3. Application in Teaching:—In geography—In arithmetic—In grammar—In botany—In zoology, etc.

III. The Culture of Classification.

1. Value of Classification:—In common life—To the student—In science.

2. Methods of cultivating Classification:—Classify objects; classify subject-matter of studies; write outlines in studies; study the classificatory sciences; study the principles of classification, etc.

3. Application in Teaching:—In orthography; In geography; In history; In arithmetic; In grammar; In natural sciences, etc.

IX. THE NATURE AND CULTURE OF JUDGMENT.

I. The Nature of Judgment.

1. Its general nature defined and illustrated:—Primitive judgments; Logical judgment; The things compared; Analytic and synthetic; Judgments of extension and intension; The proposition analyzed.

2. Nature of judgments:—Definition; Quality and quantity; Kinds of judgment; Relation of judgments; Distribution of terms; Laws of distribution; Substitutive judgments.

3. Derived judgments:—By opposition; by conversion, etc.

II. The Culture of Judgment.

1. Value of the Judgment:—To perception; To memory; To thought; To science; To poetry, etc.

2. Methods of cultivating the Judgment:—Exercises in comparison of,—forms, colors, lengths, etc.; By the studies,—arithmetic, geometry, grammar, etc.; The figures of literature; Games of skill, etc.

3. Application in Teaching:—In orthography; In geography; In arithmetic; In grammar; In geometry; In manual work, etc.

X. THE NATURE AND CULTURE OF REASONING.

I. The Nature of Reasoning.

1. Its general nature defined and illustrated. Indirect comparison; Comparison of relations; Relation to judgment; Views of different writers, etc.

2. Kinds of Reasoning:—Deduction and induction; Their relation; Kinds of truth to which each is applicable.

3. The syllogism:—Definition; the parts; the terms; the premises; the figures; laws of the syllogism.

4. Deductive reasoning:—Its nature; origin of general truths; mathematical reasoning, etc.

5. Inductive reasoning:—Its nature; its basis; its limits; criteria of induction; tests of casual agency.

5. Hypothesis and theory:—Nature of each; probability; verification; origin; value, etc.

II. The Culture of Reasoning.

1. Culture of Deductive reasoning:—Study of language; study of mathematics; study of the physical sciences; study of the philosophical sciences; care to avoid the fallacies of deduction,—(begging the question—reasoning in circle, etc.).

2. Culture of Inductive reasoning:—By inductive teaching or studying; by the study of the inductive sciences; by inductive investigations; care to avoid the fallacies of induction,—(of observation, mistaking the cause, antecedent for cause, etc.).

3. Application in Teaching:—In geography; In grammar; In arithmetic; In algebra; In geometry; In history; In natural philosophy; In physiology; In botany, etc.

4. Thought knowledge:—Relation to perceptive knowledge—Higher than perceptive knowledge—Higher than book knowledge—The triumphs of natural science—The triumphs of mathematics—The grandeur of philosophy.

XI. THE NATURE AND CULTURE OF INTUITION.

I. The Nature of Intuition.

1. Its general nature defined and illustrated:—Existence of this power; Relation to other faculties; Its products;—Primary Ideas—Primary Truths.

2. Primary Truths:—Their nature; their existence; tests of primary truths; remarks on primary truths.

3. Primary Ideas:—Space; time; identity; cause; number, etc.

4. The subject embraces;—The True—The Beautiful—The Good or Right.

XII. THE NATURE AND CULTURE OF THE TRUE.

I. The Nature of the Ideas of the True.

1. Space:—Nature of Space; nature of the idea; origin of the idea.

2. Time:—Nature of Time; nature of the idea; origin of the idea.

3. Identity:—Nature of Identity; nature of the idea; origin of the idea; kinds of identity.

4. Cause:—Nature of Cause; nature of the idea; origin of the idea.

5. Number:—Nature of Number; nature of the idea; origin of the idea.

II. The Culture of the Idea of the True.

1. The value of the idea of the True:—Basis of thought; basis of science; relation to art; relation to life.

2. Methods of cultivating the idea:—It unfolds spontaneously. The development of the idea,—of space; of time; of cause, etc.

3. Application in Teaching:—The True in Science—The True in Art—The True in Morals.

XIII. NATURE AND CULTURE OF THE BEAUTIFUL.

I. The Nature of the Beautiful.

1. The Beautiful:—Difficulty of defining. Various theories. Two classes—objective and subjective. Subjective theories:—sensation; association; symbolism. Objective theories:—utility; order and proportion; unity and variety; the spiritual theory.

2. The Sublime:—Nature of sublimity; elements of sublimity; moral sublimity.

3. The Ludicrous:—Nature of the idea; nature of the ludicrous; forms of the ludicrous.

4. The power of Taste:—Its nature; its two elements; standard of taste, etc.

II. The Culture of the Beautiful—(Æsthetic Culture).

1. The value of the idea of Beauty:—To Character; to Literature; to the Arts; to Morality; to Religion; a source of enjoyment.

2. Culture of the Æsthetic nature:—From nature; from art; by literature; by music; by certain studies; the beautiful in character, etc.

3. Application in Teaching:—Condition of the school-room; pictures; flowers; music; poetry; drawing; manners of pupils, etc.

XIV. THE NATURE AND CULTURE OF THE RIGHT.

I. The Nature of the Good, or Right.

1. Nature of the idea of the Right:—The Right—Obligation—Merit and demerit. Origin of these ideas.

2. Theories of the nature of the Right:—Happiness; utility; legal enactment; divine will, etc.; correct theory.

3. Origin of the idea of the Right:—Education; legal enactment; association; sympathy; Bain's theory; a moral sense; intuition.

4. Nature of Conscience:—Intellectual element; emotional element; their relation; what is conscience?

Nature of Ethics; diversity of moral judgments; is conscience a safe guide?

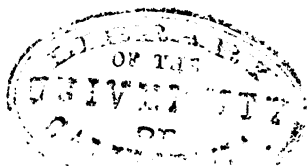
II. The Culture of the Right—(Moral Culture).

1. Nature of this culture:—Ideas to be developed;—the right—obligation—merit and demerit. The idea of duty. The different duties.

2. Value of moral ideas:—To Literature; to the Arts; to Character; to Society; to the State.

3. Principles of moral culture:—(a) Culture possible; (b) should begin early; (c) feeling with cognition; (d) in the concrete.

4. Methods of moral culture:—(a) By examples; (b) by literature; (c) by history; (d) by the Bible; (e) avoid evil influences; (f) rules of moral action; (g) moral habits; (h) moral ideals; (i) duty of parent and teacher, etc.



5. Application in Teaching:—Teachers should aim to develop the following:—

(a). Duties to self:—Self-control; purity; culture; industry; temperance; ambition; vanity; covetousness, etc.

(b). Duties to others:—Courtesy; obedience; veracity; honesty; charity; gratitude; patriotism, etc.

(c). Duties to God:—Faith; love; obedience.

NOTE.—In this brief discussion of the Right may be found the basis of a course in Moral Culture. A full treatment of the subject would embrace the Sensibilities and the Will.

THE SENSIBILITIES.

I. THE NATURE OF THE SENSIBILITIES.

Introduction:—The Sensibilities defined and illustrated. Relation to the intellect. Classification,—Emotions, Affections, and Desires. Duality of feelings. Other classifications.

I. The Simple Emotions.

The Emotions defined and illustrated. Classification,—Instinctive and Rational. Nature of each.

1. The Instinctive Emotions:—Cheerfulness and melancholy; companionship and loneliness; sympathy with happiness; sympathy with sorrow.

2. The Rational Emotions:—(a) The egoistic emotions,—pride and humility; (b) The æsthetic emotions:—novelty; wonder; beauty; sublimity; the ludicrous; (c) The ethical emotions:—obligation; satisfaction and remorse; approval or disapproval.

II. The Affections.

The Affections defined and illustrated. Classification,—Benevolent and Malevolent. Nature of each.

1. The Benevolent Affections:—Affection for kindred; friendship; gratitude; patriotism; philanthropy; piety.

2. The Malevolent Affections:—Resentment; envy; jealousy; revenge, etc.

III. The Desires.

The Desires defined and illustrated. Their basis. Relation to aversion. Classification,—Physical and Rational.

1. The Physical Desires:—Food; stimulants; activity; repose, etc.

2. The Rational Desires:—Happiness; society; wealth; power; esteem; knowledge. Hope and fear.

II. THE CULTURE OF THE SENSIBILITIES.

1. Value of the Sensibilities:—Of great value;—to the intellect; to thought; to will; to literature; to oratory; to happiness; to morality; to religion.

2. General principles of their culture:—By judicious exercise; develop the higher and repress the lower; the law of moderation.

I. Culture of the Emotions.

1. The Instinctive Emotions:—Cheerfulness; melancholy; companionship; sympathy.

2. The Rational Emotions:—Pride; humility; novelty; beauty; sublimity; the ludicrous; the moral feelings.

II. Culture of the Affections.

1. The Benevolent Affections:—Love of kindred; friendship; gratitude; patriotism; philanthropy; piety.

2. The Malevolent Affections:—Resentment; envy; jealousy; revenge, etc.

III. Culture of the Desires.

1. The Physical Desires:—Food; stimulants; activity; repose, etc.

2. The Rational Desires:—Happiness; society; wealth; power; esteem; knowledge.

THE WILL.

I. THE NATURE OF THE WILL.

Introduction.—General nature. Elements involved. Essential elements,—motive, choice, executive volition.

2. The Motive: — Definition; motive subjective; classes of motives; relation of desire and duty; relation of motive and cause.

3. The Choice:—Definition of choice; essential element; diversity of objects; liberty of selection; choice free; deliberation implied; the final decision.

4. The Executive Volition:—Its nature; relation to choice; when complete.

5. Remarks on the Will:—The will an active power; the will a cause; the conception difficult; Bain's philosophy of the will; Bain's view examined.

II. THE FREEDOM OF THE WILL.

1. The nature of freedom; a freedom from; a freedom to; "to do as we please," etc.

2. Arguments for freedom;—A general conviction; conscious of freedom; man's moral nature; consequences of the opposite, etc.

3. Objections to freedom:—Influence of sensibility; contrary choice; disposition; strongest motive; motives the cause; *dictum necessitatis*; Bain's views, etc.

III. THE CULTURE OF THE WILL.

1. Value of the Will:—To thought; to discovery; to oratory; to military success; to government; to religion; to courage; to character; to success in life.

2. Methods of cultivating the Will:—Stimulation; direction; self-control; overcoming obstacles; difficult studies; self-reliance; prompt decision; influence of other wills; moral influences.

BOOKS OF REFERENCE.—Baldwin's "Elementary Psychology;" Brooks's "Mental Science and Mental Culture;" Sully's "Hand-Book of Psychology;" Preyer's "Development of the Intellect;" Preyer's "Senses and the Will;" Porter's "Human Intellect;" Carpenter's "Mental Physiology;" Herbart's "Psychology;" Bain's "Mental Science;" Spencer's "Principles of Psychology;" Bain's "Moral Science;" Bain's "The Senses and the Intellect;" Bain's "The Emotions and the Will;" Bain's "Mind and Body;" Galton's "Natural Inheritance;" Hamilton's "Lectures on Metaphysics and Logic;" Mill's "Examination of Hamilton's Philosophy;" Ladd's "Elements of Physiological Psychology;" McCosh's "Psychology;" McCosh's "Intuitions of the Mind, Inductively Investigated;" Locke's "Essay on the Human Understanding;" Lotze's "Outlines of Psychology;" Calderwood's "The Relation of Mind and Brain;" Galton's "Inquiries into Human Faculty and its Development;" Ribot's "Diseases of Memory;" Wood's "Brain-work and Over-work;" James's "Principles of Psychology;" Ribot's "The English Psychology;" Carus's "The Soul of Man;" Lindner's "Empirical Psychology;" Kant's "Critique of Pure Reason;" Todhunter's Logic; Thomson's "Outline of the Laws of Thought;" Jevon's Logic; Hyslop's "Elements of Logic;" Mill's Logic, etc.

PART II.

Methods of Instruction ;

Or, the Science and Art of Teaching.

I. THE SCIENCE OF TEACHING.

I. THE GENERAL NATURE OF TEACHING.

1. Teaching defined. Relation to education. Its elements. Culture and Instruction.

2. Teaching a Science. Its claims to a science. Source of its laws and principles.

3. Teaching an Art. Its claims to an art. Source of its methods. The teacher an artist.

4. Teaching includes :—(a) The nature of mind; (b) The nature of knowledge; (c) The nature of instruction, its forms, order, and principles.

II. THE GENERAL NATURE OF THE MIND.

1. The Mind:—Its nature; how to study mind; its faculties.

2. General classification:—Intellect; Sensibility; Will. Their nature and relation.

3. The Intellect:—Perception; memory; imagination; understanding; intuition.

4. The Understanding:—Abstraction; conception; judgment; reasoning.

5. Other forms of mental activity:—Consciousness; attention, etc.

III. THE GENERAL NATURE OF KNOWLEDGE.

1. Nature of Knowledge. Origin and development of knowledge. Relation of knowledge to the mind. Division of knowledge;—common knowledge—scientific knowledge—“inductive and deductive” knowledge—“empirical and rational”—the “formal sciences.”

2. Classification of Knowledge:—Language; mathematics; physics; psychology; sociology; history; the arts.

3. The nature of each branch; its relation to the mind; origin of each branch; how developed.

4. Educational value of the studies:—Culture value; practical value; views of various authors upon the subject.

IV. THE FORMS OF INSTRUCTION.

1. Nature of Instruction:—Instruction defined; relation to education; embraces,—forms, order, and principles.

2. Forms of Instruction: (*a*) analytic; (*b*) synthetic; (*c*) concrete; (*d*) abstract; (*e*) inductive (*f*) deductive; (*g*) theoretical; (*h*) practical.

3. The application of each form to the different branches of study explained.

V. THE ORDER OF INSTRUCTION.

1. The nature and value of this inquiry. Different periods require different studies and methods. Four educational periods,—infancy, childhood, youth, manhood.

2. Branches to be taught:—(*a*) in infancy; (*b*) in childhood; (*c*) in youth; (*d*) in manhood.

3. The same applied to the different grades of a public school.

VI. THE PRINCIPLES OF INSTRUCTION.

1 The nature of principles; their value in teaching; three classes of principles; their origin; the application of the several principles to the different studies.

FIRST CLASS—PRINCIPLES DERIVED FROM THE NATURE OF THE MIND.

1. The primary object of teaching is to afford culture to the mind.

2. This culture should follow the natural unfolding of the powers of the child's mind.

3. The teacher should aim to give careful culture to the power of attention.

4. The teacher should aim to give careful culture to the perceptive powers of the child.

5. The teacher should aim to train the memory to operate by the laws of association and suggestion.

6. The teacher should aim to unfold the child's power of forming ideal conceptions.

7. The teacher should aim to give careful culture to the powers of abstraction and conception.

8. The teacher should take special pains to cultivate the judgment, or power of comparison, of the child.

9. A child should be taught to reason first inductively and then deductively.

10. A child should be led gradually to attain clear conceptions of intuitive ideas and truths.

NOTE.—These principles are to be explained and illustrated in the work of teaching.

SECOND CLASS—PRINCIPLES DERIVED FROM THE NATURE OF KNOWLEDGE.

1. The second object of teaching is to furnish the mind with knowledge.

2. Instruction should follow the natural order of the development of knowledge in the human mind.

3. The three principal sources of knowledge are observation, reflection, and language.

4. Things should be taught before words, and ideas should be taught before truths.

5. Particular ideas should be taught before general ideas, and particular truths before general truths.

6. The causes of facts should be taught before their laws, and causes and laws before scientific classifications.

7. The elements of the inductive sciences should precede the elements of the deductive sciences.

8. The formal study of the deductive sciences should precede that of the inductive sciences.

9. The elements of art should precede its related science, but advanced art must follow its related science.

10. The metaphysical or philosophical sciences should come last in a course of instruction.

THIRD CLASS—PRINCIPLES DERIVED FROM THE NATURE OF INSTRUCTION.

1. All instruction should seek to arouse the self-activity of the pupil.

2. The historic order of the development of knowledge is often suggestive of the proper order of instruction.

3. Elementary instruction should proceed from the simple to the complex, while advanced instruction may proceed from the complex to the simple.

4. Elementary instruction should proceed from the known to the related unknown, while advanced instruction may proceed from the unknown to the known.

5. Elementary instruction should be given in the concrete, while advanced instruction may be more abstract.

6. Both elementary and advanced instruction may be either analytic or synthetic, according to the nature of the subject.

7. Elementary instruction should be inductive, while advanced instruction may be deductive as well as inductive.

8. Elementary instruction should proceed from the practical to the theoretical, while advanced instruction may also proceed from the theoretical to the practical.

9. Elementary instruction should proceed from the conception of ideas or truths to their expression in language, while advanced instruction may also reach ideas and truths from their expression in language.

10. The arts are learned by intelligent doing, and the sciences by observation and experiment, language, and thinking.

NOTE.—It will be interesting to the teacher to note and discuss the principles of education presented by different writers. The principles given above are not designed to be exhaustive of the subject.

II. THE ART OF TEACHING.

1. The nature of art. Relation of art to science. How teaching is an art. Relation of the art to the science of teaching.

2. Teaching as an art includes :—1. The Elements of Knowledge; 2. Language; 3. Mathematics; 4. Physical Science; 5. History; 6. The Arts.

I. THE ELEMENTS OF KNOWLEDGE, OR OBJECT LESSONS.

1. Their nature; origin of object lessons; value of the lessons; errors to be avoided.

2. The course of lessons:—1. On color; 2. On form; 3. On common objects; 4. On plants; 5. On animals; 6. On minerals; 7. On facts and phenomena of nature.

3. Method of giving the lesson. Model lessons on each of the above subjects.

NOTE.—For a fuller treatment, see the Elements of Science, page 47.

II. THE LANGUAGE STUDIES.

Introduction.—The nature of Language—Origin of spoken language—Origin of English language—Origin of written language—Value of language studies.

Subjects embraced.—1. Teaching to Read; 2. Orthography; 3. Pronunciation; 4. Reading or Elocution; 5. Grammar; 6. Composition; 7. Literature; 8. Lexicology.

I. TEACHING A CHILD TO READ.

1. *Nature of the Work.*—Written language—A source of knowledge—Its difficulties—Time to begin the work.

2. *Methods of Teaching.*—Several methods. (a) Alphabetic method; (b) Word method; (c) Sentence method; (d) Phonic method. Description and discussion of each.

3. *The Correct Method.*—Combination of word, sentence, and phonic methods.

Principles of the Method.—1. Begin with words and sentences rather than with letters.

2. Let the written word be regarded as a representation of the spoken word.

3. Pass from words to their elements, and use the elements to build up new words.

The Method Described :—(a) Words and sentences; (b) Analysis into elements; (c) New words from the elements; (d) General suggestions.

4. *The Child's Expression in Reading* :—(1). The child should get the thought.

(2). The child should make the thought its own.

(3). The child should express the thought as if it were its own.

(4). The child should thus read naturally as it speaks.

(5). All artificial methods of expression should be carefully avoided.

II. TEACHING ORTHOGRAPHY.

1. *Nature of Orthography* :—Its general nature—Its difficulty—Irrregularity and its causes—Reform in spelling.

2. *Methods of teaching Orthography* :—Old methods—Modern methods—(a) The written method; (b) The oral method; (c) The spelling match.

3. *The Correct Method* :—State and discuss the principles and describe the methods.

Principles of Teaching :—(1). Teach first by writing words.

(2). The words should be written in sentences.

(3). Make use of common and familiar words.

(4). Cultivate the habit of observing the form of words.

(5). Impress mental pictures of words on the mind.

(6). Be careful not to impress misspelled words on the mind.

(7). Give attention to spelling in all the branches of study.

The Methods of Teaching :—The instruction should include the following:—

(1). Exercise in written spelling.

(2). Exercise in oral spelling.

- (3). Names of common things.
- (4). Words often misspelled.
- (5). Associate words with one another.
- (6). Give words to compose other words.
- (7). Objections to the use of false orthography.
- (8). Should rules of orthography be used ?

III. TEACHING PRONUNCIATION.

1. *Its Nature*.—Nature of Pronunciation—Importance—Difficulty—Neglect—Standards, etc.

2. *Methods of Teaching*.—Different methods of teaching Pronunciation:—(1) The associative method—(2) The phonic method—(3) The alphabetic method—(4) The phonetic method.

3. *Correct Pronunciation*.—Pronunciation includes,—Articulation and Accent.

(1). Articulation:—Its nature ; how to teach it ; phonic analysis ; errors of articulation.

(2). Accent:—Its nature ; its principles ; how to teach it ; errors of accent.

IV. TEACHING READING OR ELOCUTION.

Introduction.—1. Nature of Reading—Its importance—Its neglect—A fine art.

2. Three elements:—the Mental element—the Vocal element—the Physical element.

3. General principles of teaching Reading:—(a) Natural expression ; (b) Imitation of correct models ; (c) Application of principles ; (d) Correcting errors.

I. Teaching Primary Reading.

I. The Mental Element. Nature of the mental element—It includes:—(a) Comprehension ; (b) Appreciation ; (c) Conception.

1. *Comprehension*:—(a) Pupils should understand the meaning of words; (b) pupils should get the thought of the sentence; (c) pupils should state the thought in their own words; (d) pupils should analyze for prominent ideas; (e) the older pupils should study the reading lesson.

2. *Appreciation*:—(a) Pupils should feel the sentiment; (b) pupils should assimilate the sentiment; (c) the teacher should cultivate a taste for literature; (d) the sentiment should be adapted to the pupil.

3. *Conception*:—(a) Pupils should form mental pictures in reading; (b) abstract conceptions should be clear and vivid; (c) importance of the element of conception.

II. The Vocal Element. Nature of the vocal element—It embraces:—(a) Exercises in voice; (b) The use of the voice in reading.

1. *Vocal Exercises*:—(1) For vocal culture;—force, pitch, emphasis, etc.; (2) For correct pronunciation;—articulation, accent.

2. *The Voice in Reading*:—(1) Require natural expression; (2) Pupils should read as they talk; (3) If the talk is faulty correct it; (4) Secure correct rate, pitch, force, emphasis, melody, etc.

III. The Physical Element. 1. Nature of the physical element—What it includes—Its importance.

2. *The Body in Reading*:—Correct attitude—Position of the feet—Position of the hands—Holding the book—Turning the pages, etc.

II. Teaching Advanced Reading.

I. The Mental Element. 1. The Elements: (a) The Intellectual (comprehension); (b) The Emotional (appreciation); (c) Conception (in delivery).

2. Methods of Teaching:—Exercises—Natural expression—Principles—Correcting errors.

II. The Vocal Element. 1. The Elements:

- (a). Quantity;—force, emphasis, stress.
- (b). Compass;—key-note, slides, melody.
- (c). Time;—rate, pauses, rhythm.
- (d). Quality;—pure, orotund, tremulous, etc.

2. Methods of Teaching:—Exercises—Natural expression—Principles—Correcting errors.

III. The Physical Element. 1. The Elements:—

(a) Breathing—(b) Posture—(c) Gesture—(d) Facial expression.

2. Methods of Teaching:—Exercises—Natural expression—Principles—Correcting errors.

V. TEACHING THE MEANING AND USE OF WORDS.

1. *Nature of Subject.*—Nature of words—Origin of words—History in words—Value of words—Poetry in words—Change of words.

Methods of Teaching.—(1) By their use; (2) By reading; (3) By illustrations; (4) By definitions; (5) By synonyms; (6) Logical definitions; (7) Latin and Greek; (8) From etymology.

V. TEACHING ENGLISH GRAMMAR.

Its Nature.—The nature of grammar—The grammatical elements—Origin of the elements—Historical development—Educational value—Practical value.

2. *Teaching Grammar.*—The teaching of grammar—Errors in teaching—Methods of teaching—Etymological method—Logical method—Comparison of the two methods.

3. General Principles of Teaching.—(1) Teach grammar from language and not from definitions; (2) Make the sentence the basis of grammatical instruction; (3) Make the subject practical to the learner.

I. Methods of Teaching Primary Grammar.

1. Principles of Teaching.—(1). Teach first the grammatical idea and then the expression of it.

(2). Lead pupils to discover the grammatical ideas.

(3). Do not teach mere expressions without ideas.

(4). Do not teach “grammatical forms” to young pupils.

2. The Etymological Method.—Description of the method:—(1) The parts of speech:—noun, verb, etc.; (2) The properties of parts of speech—number, person, etc.; (3) Classes of parts of speech:—of nouns; of verbs, etc.; (4) Exercises:—parsing; analysis; false syntax.

3. The Logical Method.—Description of the method:—(1) The Sentence;—subject; predicate; copula; (2) The Elements:—principal; subordinate; limiting, etc.

4. The Correct Method.—A judicious and intelligent combination of the two methods.

II. Methods of Teaching Advanced Grammar.

1. Grammatical Elements.—Parts of speech; Classes of parts; Properties; Relations; Principles or rules.

2. Formal Parsing.—Its nature; Its value; Its object; Forms of parsing; Oral and written.

3. Grammatical Analysis.—Its nature; Its value; The method; Forms of analysis; Diagrams.

4. False Syntax.—Its object; Its value; The method.

VI. TEACHING COMPOSITION.

1. *Its Nature*.—Nature of Composition—Its value; Errors in teaching.

2. Division of the subject for teaching :—(a) Primary composition; (b) Advanced composition.

I. Primary Composition (Language Lessons).

1. *Its Nature*.—Nature of language lessons: their value; neglect.

2. *Principles of Teaching*:—(1). Language is learned by imitation and practice.

(2). Language is learned by hearing good language.

(3). Language is learned by using good language.

(4). Language is learned by reading and committing good language.

(5). Use no rules or definitions with young pupils.

3. *Course of Lessons*:—(1). Give orally and in writing the names of objects, and their actions.

(2). Exercises in talking and writing sentences about various things.

(3). Have pupils talk about something, and then write what they have said.

(4). Look at objects and describe them, first orally, then in writing.

(5). Exercise in capital letters, elements of punctuation, etc.

(6). Reproduction of stories which have been told or read to the pupils.

(7). Have pupils read a selection, and then reproduce it, both orally and in writing.

(8). Look at pictures, and tell and write stories suggested by them.

(9). Exercises in letter-writing, notes of invitation and of acceptance, etc.

(10). Commit and recite choice selections of prose and poetry.

II. Advanced Composition.

1. *Preparation*.—1. Preparation for composition includes;—*Materials*—*Words*—*Style of expression*.

Source of Material.—Observation; reading; reflection; imagination, etc.

Source of Words.—Instinctive; imitation; general reading; conscious effort; the dictionary, etc.

Style of Expression.—Reading good authors; copying productions; committing prose and poetry; exercises in declamation, etc.

2. *Principles of Teaching*.—(1). The pupil should regard a composition as the expression of what he knows.

(2). Young pupils should begin with oral compositions.

(3). The transition should be made from oral to written compositions.

(4). A pupil's observation should be made the basis of his early composition.

(5). The imagination in inventing incidents should be early brought into exercise in composition writing.

(6). The power of reflection in arriving at truths and sentiments belongs to a latter stage of composition.

(7). The reading of suitable models of composition will both direct and stimulate original work in composition.

3. *The Writing of a Composition*.—It includes,—the subject, the material, the analysis, the amplification. Discussion of each.

(1). *The Subject*.—Its importance ; adaptation ; varied ; how selected.

(2). *The Material*.—Observation ; imagination ; reflection ; conversation ; reading.

(3). *The Analysis*.—Leading ideas ; subordinate ideas ; arrangement ; unity of thought.

(4). *The Amplification*.—Introduction ; body ; conclusion.

General Suggestions.—The written form ; the corrections ; the reading ; literary exercises ; newspaper in school, etc.

VII. TEACHING LITERATURE.

1. *Its Nature*.—The nature of literature ; Ancient and modern ; Value of the study ; Classification of literary productions.

2. *Its Object*.—Objects in teaching literature :—(a) To impart a knowledge of literature ; (b) To cultivate a taste for literature ; (c) To secure skill in literary composition.

I. *Primary Methods in Literature.*

1. *Principles of Teaching* :—1. Begin with prose rather than with poetry.

2. Begin with the earlier forms of literature, as the fable, the fairy story, the historic narrative, etc.

3. Let the narrative or incident be the prominent thing considered with young pupils.

4. Have pupils reproduce orally the incidents heard or read.

5. Require pupils to invent stories, incidents, tales, etc.

6. Require pupils to commit and recite suitable extracts of prose and poetry.

2. *Methods of Teaching* :—1. List of works for young pupils to read ; 2. The method of reading these works ; 3. The method of conducting the exercises.

II. Advanced Methods in Literature.

1. *Principles of Teaching*.—1. Begin with the modern writers and proceed backward to the earlier ages.

2. Call attention to the fine sentiment and the noble characters of the literary productions.

3. Consider also the descriptions of natural scenery and the analysis of character.

4. Still later, the beautiful rhetorical figure and the artistic and felicitous use of language are to be noted.

5. Students should be required to commit and recite choice extracts or passages of prose and poetry.

6. Advanced pupils should make a critical study of literary productions, explaining historical and classical allusions, philosophical reflections, etc.

7. The ideal course should include all the masterpieces in literature from Homer to Tennyson.

2. *Methods of Teaching*.—List of authors to study; 2. Methods of studying these authors; 3. Method of conducting the recitation; 4. The cultivation of a love for literature.

III. THE MATHEMATICAL SCIENCES.

Introduction.—1. Nature of Mathematics. Branches of Mathematics;—arithmetic—geometry—algebra, etc.

2. The elements of mathematics:—Ideas,—Definitions. Truths,—Axioms—Theorems—Reasoning.

3. The value of mathematical studies:—Their practical value; their educational value.

I. TEACHING ARITHMETIC.

1. General nature of Arithmetic:—The nature of numbers. Origin of the idea. The decimal system of naming numbers. The Arabic system of writing numbers. A logical outline of arithmetic.

I. Teaching Primary Arithmetic.

1. *Introduction.*—Subjects to be taught :—(a) Ideas and language; (b) Elementary results; (c) Fundamental operations; (d) Elements of fractions; (e) Elements of denominate numbers.

2. *General principles of teaching primary arithmetic* :—

- (1). The first lessons in numbers should be given orally.
- (2). The first lessons in numbers should be given with objects.
- (3). The method of teaching should be inductive.
- (4). Mental and written exercises should be united.

I. Ideas and Expression of Numbers.—Nature of numerical ideas—Nature of the oral language of arithmetic—Nature of the written language.

1. *Principles of Teaching* :—(1). Use objects to develop the numerical ideas.

(2). Use groups of objects to develop the decimal method of numbering.

(3). Combine the figures so as to show the device of place value in writing numbers.

2. *Methods of Teaching.*—(a) Teaching the ideas and names; (b) Teaching the figures, and their combination. Describe in detail.

II. The Elementary Results.—Nature of elementary results. Methods of teaching the elementary results;—the old method; the Grube method; the Normal method.

1. *Principles of Teaching* :—(1). Teach addition and subtraction together.

(2). Teach multiplication and division together.

(3). Do not combine the four processes at first.

(4). Have pupils commit the elementary results of addition and multiplication.

(5). Lead pupils to derive the elementary differences from the elementary sums, and the elementary quotients from the elementary products.

2. *The Method* :—Addition and subtraction—Multiplication and division—Describe the method in detail.

III. The Fundamental Rules.—Nature of the fundamental rules—Relation to elementary results—The necessity of drill for facility and accuracy.

1. *Principles of Teaching* :—(1). Each process should be taught separately.

(2). Let the pupil see the reason for the methods of operation.

(3). Do not require pupils to commit rules for the operations.

(4). Drill pupils in the processes until they attain skill and accuracy in them.

2. *Method of Teaching.*—Addition; Subtraction; Multiplication; Division. Describe the method of teaching each.

IV. Elements of Denominate Numbers.—Nature of Denominate numbers—Irrregularity of scales—Inconvenience—Metric system.

1. *Principles of Teaching* :—(1). Teach by means of the actual measures.

(2). Require pupils to make a practical application of the measures.

(3). Have pupils estimate length, distance, weight, etc.

2. *Method of Teaching* :—Length; Surface; Volume; Weight; Capacity, etc. Describe in detail.

V. The Elements of Fractions.—The nature of a Fraction—Its relation to the unit—The notation of fractions—Complexity of the conception of the notation.

1. *Principles of Teaching* :—(1). Develop the fractional ideas by means of objects.

(2). Pass from parts of a unit to parts of collections.

(3). Illustrate the processes with objects, lines, circles, squares, etc.

(4). Lead pupils to analyze the problems by reasoning from the unit.

(5). Derive the methods or rules by analysis and induction.

2. *Method of Teaching* :—(1). Introductory exercises :—
(a) Parts of unit; (b) Parts of numbers; (c) Fractional expressions, etc.

(2). Reduction of Fractions :—(a) Numbers to fractions; (b) Fractions to numbers; (c) To higher terms; (d) To lower terms, etc.

(3). Addition and Subtraction :—(a) Denominators alike; (b) Denominators unlike.

(4). Multiplication and Division :—(a) Fraction by number; (b) Number by fraction; (c) Fraction by fraction;

(5). The Relations of fractions :—(a) Fraction to a number; (b) Number to a fraction; (c) Fraction to a fraction.

NOTE.—A teacher should be able to show how to illustrate, analyze, and derive the rule in each one of these cases.

II. *Teaching Advanced Arithmetic.*

1. *The Course Includes*.—The course in advanced arithmetic includes the following subjects :—

- | | |
|--------------------------------|-------------------------------|
| 1. Notation and numeration. | 6. Decimal fractions. |
| 2. Fundamental rules. | 7. Denominate numbers. |
| 3. Factoring and cancellation. | 8. Percentage and interest. |
| 4. Divisors, multiples, etc. | 9. Proportion, etc. |
| 5. Common fractions. | 10. Involution and evolution. |

2. *Methods of Teaching*.—For methods of teaching, see suggestions for grammar school course in arithmetic.

NOTE.—A teacher should be able to discuss the nature of each one of these subjects, and state the principles and describe the methods of teaching each.

III. General Suggestions.

1. *Mental Arithmetic*.—Its nature; its value; its abuse; methods of recitation, etc.

2. *Written Arithmetic*.—Its nature; forms of written work; methods of recitation, etc.

II. TEACHING GEOMETRY.

Introduction.—1. Nature of geometry—Divisions. Origin of geometry.

2. Value of geometry :—Educational value; practical value.

3. Things to be taught :—Geometrical ideas; Geometrical truths.

I. Teaching the Elements of Geometry.

1. *Nature of the Subject*.—Nature of the elements—Compared with arithmetic—Importance of teaching the elements to children.

2. *Principles of Teaching*.—

(1). The elements of geometry should precede the elements of arithmetic.

(2). The reasoning of geometry should follow the reasoning of arithmetic.

(3). The methods of teaching the elements should be concrete and inductive.

3. *Methods of Teaching*.—

The geometrical Ideas :—(1). The elements :—solid; surface; line; angle.

(2). Lines :—straight; curved; broken.

(3). Surfaces:—triangle; quadrilateral; parallelogram; rectangle, etc.

(4). Solids:—cube; parallelopiped; pyramid; sphere; cylinder; cone, etc.

(5). Angles:—acute; obtuse; right.

The geometrical Truths:—(1) Self-evident truths; (2) Truths by concrete demonstration; (3) Truths to be taken on faith.

II. Teaching Geometry as a Science.

1. *Nature of the Subject*:—(1). Definitions:—their nature—how to teach them.

(2). Axioms:—their nature—how to teach them.

(3). Demonstrations:—nature—kinds—errors—how to teach.

(4). Practical problems:—nature—importance—how to use them.

(5). Undemonstrated theorems:—nature—importance—how to use them.

2. *The Recitation in Geometry*.—(a) Assignment; (b) Construction; (c) Demonstration; (d) Criticism; (e) Questioning; (f) Outlines, etc.

III. TEACHING ALGEBRA.

Introduction.—1. Nature of algebra. History of algebra; Relation to arithmetic. Symbols. Generalization. Algebraic reasoning. The equation. Deduction. Induction, etc. Mathematical induction, etc.

2. Value of the study:—Educational value; practical value.

I. The Elements of Algebra.

1. *The Principles of Teaching*:—

(1). A careful transition should be made from arithmetic to algebra.

(2). Pupils should begin with concrete problems rather than with abstract exercises.

(3). Pupils should be led gradually to the process of generalization.

(4). There should be a thorough drill in all the processes.

(5). The interpretation of general formulas should be a prominent exercise.

2. *The Methods of Teaching*.—(a) Introduction; (b) notation; (c) negative quantity; (d) fundamental rules; (e) composition; (f) factoring; (g) fractions; (h) simple equations; (i) involution and evolution; (j) quadratic equations; (k) the progressions, etc.

3. *General Suggestions*.—(1) The literal notation; (2) Positive and negative quantities; (3) Exponents—general—negative—fractional, etc.; (4) Generalization—interpretation, etc.

IV. THE PHYSICAL SCIENCES.

Introduction.—Nature of the physical sciences. Classification of the physical sciences. Elements of the physical sciences. Development of the physical sciences. Value of the physical sciences.

I. TEACHING GEOGRAPHY.

1. *Nature of Geography*.—Divisions; origin; value,—educational—practical.

2. *Methods of Teaching Geography*.—(a) The synthetic method; (b) The analytic method; (c) The inductive method; (d) The deductive method.

3. *Courses in Geography*.—(a) Primary geography; (b) Advanced geography.

I. Teaching Primary Geography.

1. *Nature of the Subject*.—Nature of course in primary geography—What it embraces—When it should be begun.

2. *Principles of Teaching* :—(1). The first lesson in geography should be in the concrete.

(2). The course should be first synthetic then analytic.

(3). The facts should be presented before their classification or causes.

(4). The course should begin with local and descriptive geography.

(5). The course should combine history with geography.

3. *Methods of Teaching* :—(1). Perception of geographical facts :—Land ; water ; soil ; people, etc.

(2). Conception of geographical facts :—Land ;—mountain ; prairie ; desert, etc. Water ;—lake ; river ; strait ; ocean, etc.

(3). Representation of geographical facts :—Direction ; making maps ; lessons on maps, etc.

(4). Explanation of geographical facts :—Form of earth ; motions of earth ; equator ; parallels ; meridians ; zones ; seasons, etc.

II. Teaching Advanced Geography.

1. *Nature of the Subject*.—General nature—Relation to primary course—Includes Descriptive and Physical.

2. *Principles of Teaching* :—(1). The method should be analytic as well as synthetic.

(2). The course should include the classification of facts.

(3). The course should include an inquiry into the causes of the facts.

(4). All possible devices should be employed to make the facts realistic to the mind of the student.

3. *Methods of Teaching*.—(a) Definitions; (b) descriptions; (c) lessons on maps; (d) drawing maps; (e) interesting facts; (f) imaginary travels; (g) geographical outlines; (h) use of pictures, projections, etc.; (i) physical geography; (j) mathematical geography.

II. TEACHING PHYSIOLOGY.

1. *Nature of the Subject*.—Its general nature. Divisions for instruction. Value of the knowledge. Evils of ignorance. Relative importance of anatomy, physiology and hygiene.

2. *Principles of Teaching*.—(1). Instruction,—elements orally, advanced course with books. (2). Pupils learn,—by observation—by description—by drawing the parts. (3). Materials used,—the human body—parts of animals—plaster models—charts, etc.

3. *Elementary Course*.—(1). Anatomy and physiology:—Head—neck—trunk—arms—hands—legs—feet—bones—muscles—blood—heart, etc. (2). Hygiene:—Food—air—clothing—exercise—sunshine—sleep—bathing—nails—hair—eyes—ears—teeth, etc., effects of alcohol, etc.

4. *Advanced Course*.—(1). Subjects:—The bones—muscles—digestion—circulation—respiration—the skin—nervous system—organs of sense.

(2). Method:—Describe structure, use, laws of health, effect of alcohol and narcotics, etc.

III. THE ELEMENTS OF SCIENCE.

1. *Nature of the Elements*.—Object of this instruction; Value of this instruction. Subjects embraced;—plants—animals—minerals—air—water—heat—magnetism and electricity.

2. *Principles of Teaching*:—(1). Pupils obtain their knowledge from the object, and not from books.

(2). Pupils should be led to observe the phenomena of nature.

(3). Teacher should perform, and have pupils perform experiments.

(4). Pupils should describe objects through the language of words and drawing.

(5). Teacher should endeavor to cultivate an interest in the study of nature, her objects and forces.

3. *Course of Lessons*:—(1). PLANTS:—The leaf; the flower; various flowers; fruits; seeds; germination; growth; local flora.

(2). ANIMALS:—Starfish; sea-urchin; oyster; clam; snail; shells; lobster; crab; bee; grasshopper; cricket, etc; domestic animals; wild animals seen at the zoological gardens.

(3). MINERALS:—Quartz; feldspar; mica; hornblende; granite; puddingstone; slate; trap; marble; iron; copper; lead, etc.

(4). HEAT:—The flame—the candle—smoke—conduction—convection—radiation—simple experiments.

(5). AIR:—Its presence:—combustion; ventilation. Its pressure:—lifting-pump; force-pump; barometer; siphon. Elasticity of air:—the pop-gun; hydraulic fountain; air-brake; air-pump.

(6). WATER:—Its pressure:—equilibrium; fountains; artesian wells; city water system; hydrostatic press; elevators; cotton-presses. Capillarity:—tubes; blotter and ink; towel and water. Buoyancy:—boats; swimming; specific gravity.

(7). **ELECTRICITY AND MAGNETISM**.—Frictional electricity; magnetism; dynamic electricity; the telegraph; the telephone, etc.; simple experiments.

NOTE.—For books of reference, see "Simple Experiments in the School-room," *J. F. Woodhull*; "Chemical History of a Candle," *Faraday*; "General History of Fire," *Tyler*.

V. TEACHING HISTORY.

Introduction.—1. Nature of History; divisions; facts; philosophy, etc.

2. Value of the study of History:—educational value; practical value.

I. Teaching the Elements of History.

1. *Nature of the Subject*.—Nature of the elements of history—What should be embraced—The value of such lessons.

2. *Principles of Teaching*.:—(1). The first lessons in history should be given orally.

(2). The first lessons in history should begin at home.

(3). The basis of instruction in the elements of history is biography.

(4). The first lessons in history should be given in the form of narratives.

(5). The elements of history should be taught in connection with geography.

3. *Methods of Teaching*.—The teacher's statement; the pupil's recitation; biography; historic narratives; home history; read histories; pupils bring historic matter into the school; use of blackboard and maps.

II. Teaching Advanced History.

1. *Nature of the History.*—Systematic; style; illustrations; leading events; historic centres; cause and effect; general history, etc.

2. *Students' Preparation.*—Use of the text-book; books of reference; use of a library; original investigations; graphic outlines, etc.

3. *The Recitation in History.*—Topical recitation; order of recitation; questioning; new matter; reviews; discussions; dates; cause and effect; maps and charts; pupils make maps; lectures, etc.

III. Civil Government, or Civics.

1. *Its Nature.*—Nature of civics. Value of a knowledge of civics.

2. *Methods.*—Course of instruction. Principles of instruction. Methods of instruction.

VI. THE ARTS.

Introduction.—Nature of Art—Its relation to science—The useful arts—The fine arts—Value of art—Educational value—The school arts,—writing, singing, drawing, etc.

I. Teaching Writing.

1. Principles of teaching.
2. Methods of teaching.

II. Teaching Vocal Music.

1. Value of vocal music.
2. Principles of teaching.
3. Methods of teaching.

III. Teaching Modeling.

1. Value of modeling.
2. Principles of teaching.
3. Methods of teaching: (a) in the solid; (b) in relief.

IV. Teaching Drawing.

1. Value of drawing.
2. Principles of teaching.
3. Methods of teaching: (a) surface drawing; (b) solid drawing.

V. Manual Training.

1. Nature and value of manual training.
2. Course of instruction in manual training.
3. Methods of instruction in manual training.

NOTE.—Special courses of instruction are being prepared for each one of the school arts and they are thus omitted in this general syllabus.

BOOKS OF REFERENCE.—Brooks's "Normal Methods of Teaching;" Bain's "Education as a Science;" Compayre's "Lectures on Pedagogy;" Currie's "Common School Education;" Fitch's "Lectures on Teaching;" Johonnot's "Principles and Practice of Teaching;" Page's "Theory and Practice of Teaching;" Prince's "Courses and Methods;" Parker's "Talks on Teaching;" Parker's "How to Study Geography;" King's "Methods and Aids in Geography;" Klemm's "European Schools;" Greenwood's "Principles of Education Practically Applied;" Raub's "Methods of Teaching;" Wickersham's "Methods of Instruction;" Hall's "Method of Teaching History;" Howland's "Practical Hints for Teachers of Public Schools;" Frye's "The Child and Nature;" White's "Elements of Pedagogy;" De Garmo's "Essentials of Method;" Patridge's "Quincy Methods;" Calderwood "On Teaching;" Rosmini's "Method in Education;" Shoup's "History and Science of Education;" Laurie's "Lectures on Language and Linguistic Method;" Prince's "Schools and Methods in Germany."

PART III.

School Economy.

Introduction.—Nature of the subject; what it embraces; the term school economy; other terms applied to the subject.

I. PREPARATION FOR THE SCHOOL.

1. *School Grounds.*—(a). Location:—convenient; suitable; healthful, etc.

(b). Arrangement;—size; shape; plan; apparatus.

2. *School Buildings.*—Size and form: internal arrangement; the basement; heating; ventilation; lighting, etc.

3. *School Furniture.*—Desks and seats; blackboards; blinds and curtains, etc.

4. *School Appliances.*—Text-books; charts; maps; globes; pens; pencils; slates; apparatus; specimens; library, etc.

5. *School Studies.*—For primary schools; for grammar schools; for high schools; for normal schools; for technical schools; for colleges.

II. ORGANIZATION OF THE SCHOOL.

1. *The Order.*—Admission; school hours; classification; the seating; intermission; communicating; signals, etc.

2. *The Studies*.—Text-books; formation of classes; assignment of classes to teachers; program of recitation; time for study, etc.

III. SCHOOL EMPLOYMENTS.

1. *Study*.—The objects; the incentives; modes of study; characteristics of a student; home study, etc.

2. *Recitation*.—The objects; the methods; teacher's preparation; pupil's preparation; reviews; examination; marking systems; graduation.

3. *Exercises*.—Plays; gymnastics; the Swedish system; the German system, etc.

IV. SCHOOL GOVERNMENT.

I. School Duties.—To the pupils; to the teacher; to school property; to visitors, etc.

II. School Regulations.—To secure good conduct; to prevent misconduct; to correct misconduct.

III. School Punishments.—The object of penalties; principle of penalty; the kind of penalties; the method of punishments; improper punishments.

V. SCHOOL AUTHORITIES.

I. The Teacher.—His qualifications; duties to pupils; duties to his profession; duties to the public.

II. School Officers.—Board of control; local boards; the superintendency.

III. The Patrons.—Their duties to the school; to the teacher; to their children.

VI. SCHOOL SYSTEMS.

I. The American System.—Public schools; academies and seminaries; technical schools; colleges; universities, etc.

II. The German System.—The folks' school; the real schools; the gymnasia; the universities.

III. The French System.—The maternal schools; the elementary schools; the Lycée; the "Five Faculties."

IV. The English System.—Board schools; free schools; secondary schools; universities; technical schools.

CONCLUSION.

Relation of Education.—To labor; to health; to crime; to happiness; to government; to civilization.

BOOKS OF REFERENCE.—Wickersham's "School Economy;" Raub's "Methods of School Management;" Baldwin's "Art of School Management;" Morrison's "Ventilation and Warming of School Buildings;" Kellogg's "School Management;" Landon's "School Management;" Payne's "Chapters on School Supervision;" Prince's "School Management, etc.;" Pickard's "School Supervision;" Newsholme's "School Hygiene;" Howland's "Practical Hints to Teachers;" Meyer's "Aids to Family Government," etc.

PART IV.

The History of Education.

I. INTRODUCTION.

Its place in a scheme of pedagogy. Its interest. Its value to teachers. What it embraces. Development of the individual—of science, art, and literature—of civilization. Methods of study.

II. ORIENTAL EDUCATION.

1. China:—The people; their character; religion; learning; system of education; influence of learned men; female education.

2. India:—Character of the people; religion; caste; learning; system of education; female education.

3. Persia:—Character of the people; religion; the magi; learning; system of education; female education.

4. Egypt:—Character of the people; caste; priests; learning; their arts; system of education; female education.

5. Judea:—Character of the people; religion; learning; literature; system of education; female education; influence on civilization.

III. GRECIAN EDUCATION.

1. The Greeks:—Their origin; character; language; literature; science; art; cause of their high development, etc.

2. Sparta:—Character of its people; its laws; system of education,—physical, intellectual, and moral education; female education.

3. Pythagoras (580 B. C.):—His life; his school; his system; his philosophy; his methods.

4. Athens:—Character of its people; its learning; literature; oratory; sculpture; architecture; system of education,—intellectual, physical and moral; female education.

5. Athenian Educators:—Socrates;—his life—character—methods of instruction; influence. Plato;—his life; works—philosophy—views on education—principles of instruction—influence. Aristotle;—his life—works—philosophy—views on education—principles of instruction—influence.

6. Alexandria:—The great library; The Septuagint. Teachers of science;—Euclid (fl. 300 B. C.)—Archimedes (287 B. C.); Apollonius (221 B. C.): Ptolemy (125 A. D.); Galen (fl. 130 A. D.); Hypatia (fl. 415 A. D.); Plutarch (40–120). Teachers of Christianity:—Polycarp—Ignatius—Justin Martyr—Origen, etc. Decline of Greek learning. Influence on the Romans.

7. Influence of Greek culture,—on science—on art—on education—on civilization.

IV. ROMAN EDUCATION.

1. The Romans:—Their origin; language; general characteristics; Grecian influence.

2. System of education:—Their schools; the teachers; *literator* and *literator*; course of training; female education; influence of Greece.

3. Educational writers:—Cicero (106–43 B. C.);—his life—educational views. Seneca (12–69 A. D.);—his life—educational views. Quintilian (40–118 A. D.);—his life—works—educational views—system of instruction.

5. Influence of Roman culture on education and civilization.

V. CHRISTIANITY AND THE MIDDLE AGES.

I. Early Christianity.

1. Christ:—His education; life; character; as a teacher; His method; His doctrines; His influence.

2. Early Christians:—Their education; social life; home instruction; catechetical schools.

3. The Fathers of the Church:—Tertullian; St. Jerome; St. Augustine; their character; educational views.

4. Influence of Christianity on woman.

II. Education During the Middle Ages.

1. Decline of learning. Causes of the decline;—Opposition of Christianity to Greek literature—Destruction of the Alexandrian library—Fall of the Roman empire—Conquests of the Saracens—Asceticism. General ignorance.

2. Schools of the Church:—Monastic schools; cathedral schools; parochial schools; the seven liberal arts,—the *trivium* and *quadrivium*.

3. Charlemagne (768–814);—His interest in education; Alcuin (735–804).

4. Alfred the Great (848–901);—His interest in education; his studies and writings.

5. Chivalry;—Its rise; its influence on character; on social life; on education.

6. Rise of secular education; town or burgher schools.

7. Education of women.

VI. THE REVIVAL OF LEARNING (12-15 C.).

1. Causes of the revival:—The Crusades; Saracen learning; downfall of Constantinople (1453); study of classical literature; invention of printing; growth of spirit of freedom; decline of feudalism; elevation of the middle classes.

2. Italy:—Literature;—Dante (1265)—Petrarch (1304)—Boccaccio (1313). The Arts;—Pisano (1208)—Giotto (1276)—Fra Angelico (1387)—Brunelleschi (1377)—Ghiberti (1381). Eminent teachers;—Gerson (1363)—Vittorino (1379)—Æneas Sylvius (1405). Influence of Greek scholars; establishment of libraries; University of Bologna (12 C.).

3. France:—The Troubadours; the Trouvieres; Abelard (1079); Scholasticism and “the seven liberal arts;” Roscellinus (1092),—“nominalism and realism;” the University of Paris (12 C.); Thomas Aquinas (1227); Froissart (1337).

4. England:—The Norman Conquest (1066); Le Franc (d. 1089); Anselm (d. 1109); Wickliffe (1324); Sir John de Mandeville (1300); Geoffrey Chaucer (1328-1400); William Caxton (1412); Universities of Oxford and Cambridge (13 C.).

5. Germany:—The Minnesingers; the Master Singers; the Brethren of the Common Life (14 C.); the Universities (14 C.); Thomas à Kempis (d. 1471).

VII. THE RENAISSANCE OF THE SIXTEENTH CENTURY.

1. Meaning of the Renaissance. Progress in literature, art, and science. Study of ancient languages. Humanism in education. Causes of the Renaissance.

2. Italy (æsthetic education):—Literature;—Lorenzo de Medici (1448)—Ariosto (1474)—Tasso (1544), etc. The Arts;—Leonardo da Vinci (1452)—Michael Angelo (1474)—Titian (1477)—Raphael (1483), etc. The Sciences;—Columbus (1435)—Galileo (1564)—Cardano (1501)—Tartaglia (1500), etc.

3. Germany:—The Humanists;—Agricola (1443)—Reuchlin (1455)—Erasmus (1467)—their educational works and views. Theological humanist;—John Sturm (1507)—his works—his school—his methods—his influence. The universities.

4. France:—Church Schools;—the schools of the Jesuits—their studies—methods of teaching—methods of discipline—their influence.

5. England (practical schoolmasters);—Lily (1468)—his grammar; Ascham (1515)—his “Scholemaster;” Mulcaster (1530)—his “Positions” and his “Elementarie;” Colet (1466).

6. The Reformation:—Wickliffe (1324); Erasmus (1467); Luther (1483); Melancthon (1497); Zwingli (1494); Calvin (1509); the influence of each on education; general educational influence of the Reformation.

VII. THE REALISTS, OR THE NEW EDUCATION (SIXTEENTH AND SEVENTEENTH CENTURIES).

Reaction against abstract education; progress in science; progress in literature; intellectual emancipation.

1. France:—Rabelais (1483),—his life—writings—educational doctrines and influence. Montaigne (1533),—his life—writings—educational doctrines—influence.

2. England:—Bacon (1560),—his life—philosophy—writings—educational doctrines—influence on philosophy and education. Milton (1608),—his life—writings—educational views and influence.

3. Germany:—Ratich (1571),—his life—educational work—principles of teaching—influence.

4. Moravia:—Comenius (1592),—his life—educational work—writings—grades of schools—principles of teaching—influence on education.

IX. EDUCATION IN THE SEVENTEENTH CENTURY.

Progress slow; popular education not recognized; further planting of new ideas.

1. England:—Locke (1632),—his life—philosophy—educational doctrines—influence.

2. France:—Jansenism and Port Royal schools; their methods. Pascal (1628). Fenelon (1651),—his writings—educational views—labors. Rollin (1661),—his writings—labors—educational views.

La Salle (1651) (the Christian schools),—his life—character—labors—writings—educational views—teachers' seminary.

3. Germany:—Francke (1663),—his life—work—views—teachers' seminary—influence.

4. Education of women in the seventeenth century.

X. EDUCATION IN THE EIGHTEENTH CENTURY.

Progress in educational thought and practice; the methods of nature; growth of the idea of popular education.

1. France:—Rousseau (1712); the naturalistic school; his life—character—his *Émilé*—educational doctrines—his influence.

2. Germany:—Basedow (1723); the philanthropist; his life—character—educational work—methods—influence.

3. Switzerland :—Pestalozzi (1746) ; life ; character ; educational experiments ; his educational writings ; educational views ; merits and demerits ; influence upon education.

4. The humanistic education ; nature of humanism ; representatives ; their influence.

5. Education of women in the eighteenth century.

X. EDUCATION IN THE NINETEENTH CENTURY.

The golden age of education ; general adoption of new ideas ; recognition of the principle of popular education ; establishment of public schools ; college education modified ; female education provided for ; establishment of normal schools, etc.

1. Switzerland :—Pere Girard (1765),—his life—educational work—educational doctrines—educational influence.

2. France :—Jacotot (1770),—his life—his doctrines—his influence. Madame de Genlis ; Madame Guizot ; Madame Necker, etc. The Natural Schools.

3. Germany :—Froebel (1782),—his life—educational labors—educational doctrines—the kindergarten—influence on education. The State Schools.

4. England :—Bell ; Lancaster ; Wilderspin ; Stow ; Hannah Moore ; Dr. Arnold. System of schools.

5. America :—Horace Mann ; Cyrus Pearce ; David P. Page ; Warren P. Colburn ; Mary Lyon ; Emma Willard, etc. The Public Schools.

XI. RECENT EDUCATORS.

French :—Saint Simon ; Fourier ; Comte ; Dupanloup ; Buisson ; Compayré.

German :—Herbart ; Beneke ; Dressler ; Grube ; Schmidt.

English:—Herbert Spencer; Alexander Bain; J. G. Fitch; R. H. Quick; S. S. Laurie.

American:—Henry Barnard; Thomas H. Burrows; James P. Wickersham; John D. Philbrick, etc.

XIII. HISTORY OF EDUCATION IN THE UNITED STATES.

Public schools :—their origin ; origin in Pennsylvania ; in Philadelphia.

Colleges and Universities :—their origin ; growth ; eminent men connected with them, etc.

Normal schools : their origin ; development ; eminent men connected with them.

Female education : seminaries ; women's colleges ; admission into men's colleges, etc.

Teachers' Institutes : State Teachers' Association ; National Educational Association ; The National Bureau of Education.

XIV. CONTEMPORARY PUBLIC EDUCATION.

In Germany : the primary schools ; the gymnasias ; the real schools ; the universities.

In France : maternal schools ; elementary schools ; lyceums ; the "Five Faculties."

In England : board schools ; free schools ; endowed schools ; universities.

BOOKS FOR STUDY AND REFERENCE.

GENERAL HISTORIES.—Painter's "History of Education ;" Compayre's "History of Pedagogy ;" Browning's "Educational Theories ;" "History and Progress of Education," by Philobiblius ; Quick's "Educational Reformers ;" Hailman's "History of Pedagogy."

SPECIAL TREATISES.—Laurie's "Rise of Universities ;" Laurie's "Comenius ;" Barnard's "German Teachers and Educators ;" Staunton's "Schools of England ;" Morley's "Rousseau ;" "Rousseau's Émilé," by W. H. Payne ; De Guimp's "Pestalozzi ;" Krüsi's "Life of Pestalozzi ;" Pestalozzi's "Leonard and Gertrude ;" Leitch's "Practical

Educationists;" Joseph Payne's Lecture on Jacotot in "Lectures on the Science and Art of Education;" Gill's "Systems of Education;" "Reminiscences of Froebel," by Von Marenholz-Bulow;" "Memoir of Froebel," Milton Bradley & Co.; Hallman's "Kindergarten Culture;" Froebel's "Education of Man;" "Free School System in the United States," Charles Francis Adams; Wickersham's "History of Education in Pennsylvania;" Boone's "History of Education in the United States;" Helene Lange's "Higher Education of Women in Europe;" Joseph Payne's "Visit to German Schools;" Matthew Arnold's "Report on Schools of France and Germany," and "Higher Schools and Universities of Germany;" Klemm's "Visit to European Schools;" Bardeen's "French Schools through American Eyes;" Grasby's "Teaching in Three Continents;" Mullinger's "History of the University of Cambridge;" Lyte's "History of the University of Oxford;" Draper's "Intellectual Development of Europe;" "Ignatius Loyola," by Hughes; "The Jansenists," by Sainte Beuve.

WORKS FOR GENERAL READING.—Mahaffy's "Old Greek Education;" Church's "Roman Life in the Days of Cicero," Chapters I and II; Stillé's "Studies in Mediæval History," Chapters XII, XIII, XIV; Maitland's "The Dark Ages;" Gibbon "Student Edition," Vols. II and III; Mullinger's "History of the Schools of Charles the Great;" Townsend's "Great Schoolmen of the Middle Ages;" Stubbs's "Lectures on Mediæval and Modern History," Chapters VI and VII; Conde's "The Arabs in Spain;" Symond's "Renaissance in Italy;"—"The Revival of Learning;" Pater's "The Renaissance;" Green's "Shorter History of the English People," Chapters I, II, III, VI."

FOR CONTEMPORARY EDUCATION.—See Reports of the U. S. Commissioner of Education, Department of the Interior.

It would be well for students of the history of education to read in connection with the subject some good general outline of the history of Europe, as Freeman's "General History of Europe." Barnard's "Journal of Education" is a rich mine of information on the history of systems and methods. The article on Education in the "Encyclopædia Britannica" is a valuable monograph upon the subject. Bohn's Editions of Plato, Aristotle, and Quintilian are also recommended; especially Plato's "Republic," Aristotle's "Politics and Economics" and Quintilian's "Institutes of Oratory."

THE
COURSE OF STUDY
IN
ARITHMETIC

FOR THE
PUBLIC SCHOOLS OF PHILADELPHIA

PREPARED BY
EDWARD BROOKS
Superintendent of Public Schools, Philadelphia, Pa.



PHILADELPHIA:
BORK & MCFETRIDGE, PRINTERS, 306-308 CHESTNUT ST.

1892



Philadelphia Board of
" Public Education

THE
COURSE OF STUDY
IN
ARITHMETIC

FOR THE
PUBLIC SCHOOLS OF PHILADELPHIA

PREPARED BY
EDWARD BROOKS
Superintendent of Public Schools, Philadelphia, Pa.

PHILADELPHIA:
BURK & MCFETRIDGE, PRINTERS, 306-308 CHESTNUT ST.

1892



Course of Instruction in Arithmetic

FOR THE PUBLIC SCHOOLS OF PHILADELPHIA.

INTRODUCTION.

Arithmetic is a science and an art. As a science it treats of the relations and principles of numbers. As an art it includes the various operations with numbers. In teaching arithmetic, the object is to make pupils familiar with both the science and the art of numbers.

The art of arithmetic and much of the science grow out of the language used in expressing numbers. This language is based upon the decimal system of grouping numbers and the Arabic system of writing numbers. This system of naming and writing numbers is purely conventional and has no necessary relation to numbers. Given another method of naming and writing numbers, and our arithmetic would be very materially changed.

The science and art of arithmetic are based upon four fundamental operations, viz.: addition, subtraction, multiplication, and division. Addition and subtraction are the two primary forms of synthesis and analysis; multiplication and division are the two derivative processes of synthesis and analysis. These processes, called the *fundamental operations* of arithmetic, involve certain elementary combinations which may be called "elementary

results." These "elementary results" are the sums of the "addition table," extending as far as "9 and 9," and the products of the multiplication table extending as far as "9 times 9." The corresponding elementary differences and quotients are immediately derived from these results. By means of these elementary results we are enabled to operate with large numbers, and to perform all the calculations of the fundamental operations. A clear conception of these facts will shape the methods of primary instruction in numbers.

I. *Ideas and Language.*—As thought and expression are so intimately allied, the methods of naming and writing numbers modify our conceptions of numbers. The oral language of arithmetic is based upon a principle peculiarly simple and ingenious. Instead of giving independent names to the different numbers, which would require more names to count even a million than one could acquire in a life-time, the method of classifying units into tens, hundreds, etc., has been adopted. This enables the mind to form clear and distinct ideas of large numbers which would otherwise be exceedingly difficult if not impossible. The method of writing numbers is based upon the ingenious device of place value, which is regarded as one of the happiest results of human intelligence. By this method the mind is enabled to conceive and to operate with numbers far beyond what would be possible without some such system. These facts with respect to the conception and expression of numbers, serve to shape the methods of primary instruction in arithmetic.

II. *Elementary Results.*—These elementary results, consisting of the sums of the addition table and the products of the multiplication table, are to be committed to memory. No progress can be made in the art of calculation until this is accomplished. The amount to be thus committed depends upon the systems of numeration and notation which have been adopted. If the base of the

method of naming numbers was smaller than *ten*, the time for learning these results would be lessened. If we had a binary system, as advocated by Leibnitz, the task could be accomplished in a few minutes. If our system were quaternary—that is, if it had *four* as the base, these elements could be learned in a few days. The elementary sums would include results only as far as $3+3$; and the multiplication table would include the products only as far as “2 times 3” and “3 times 3.” In the decimal system, these elements extend necessarily as far as “9 and 9” and “9 times 9,” and it requires a child two or three years to master these tables of elementary results. It is thus seen that much of the time necessarily spent in teaching arithmetic is due, not to the nature of number itself, but to the system of arithmetical language adopted.

There are, or have been, at least three distinct ways of learning these elementary results of the addition and the multiplication tables. The old way was to have the child study the tables, repeating the combinations verbally until they were committed to memory. There was no illustration, no attempt to show the meaning or origin of the results, but merely a repeating of words until they became fixed in the mind. A newer way is the Grube Method, in which the four processes of addition, subtraction, multiplication and division are united in the study of each number in order from *one* to *one hundred*, the processes to be performed with objects and repeated until the child remembers the results. The third and still newer method, which may be called the Normal Method, is that which combines addition and subtraction, and afterward multiplication and division, but not the four processes at first. It illustrates the operations and results with objects, and also requires that special pains be taken to have pupils remember the elementary results.

In this discussion it will be noted that we have limited the elementary sums to “9 and 9” and the elementary

products to "9 times 9." This is really as far as the sums and products need to be committed for any practical purpose. It is, however, customary to extend them as far as "12 and 12" and "12 times 12," since the names of the numbers up to twelve suggest a duodecimal basis of numbering. Teachers, of course, are expected to follow this custom.

As previously stated, it is necessary to fix in the memory the elementary results of addition and multiplication. Pupils must know the elementary sums as far as "9 and 9," and then they can readily derive the sums of the larger numbers by using these elementary sums and the principle of the Arabic notation. So, also, pupils must know the elementary products as far as "9 times 9," and from these they can readily find the products of larger numbers. Special pains must, therefore, be taken to have pupils commit the elementary sums and products, so that they may spring up in the mind spontaneously and automatically when needed. The elementary differences are readily derived from the elementary sums and the elementary quotients from the elementary products, and thus no special pains need be taken to have them committed to memory.

III. *The Fundamental Operations.*—The elementary results having been learned, the pupil is prepared for the Fundamental Operations. These include written exercises in addition, subtraction, multiplication and division. The operations apply to large numbers expressed in the Arabic system of notation. These operations are mechanical in their nature, though involving some scientific principles; and it requires practice and drill to become familiar with them. The primary object with young pupils is to have them acquire facility and accuracy in these mechanical operations.

This is the art of arithmetic; and it will be remembered that an art is learned by practice. "We learn to

do by doing," is especially applicable here. It requires constant drill in these processes to attain quickness and accuracy in obtaining results. The operations require but little thought—a machine can be made to do them—but children should begin them early, and must be kept at them until they can "calculate" quickly and accurately.

IV. *Arithmetical Reasoning.*—Arithmetic is also a science—a science of interesting and beautiful relations; and we are to teach the science as well as the art. Thought is to be evolved and the power to judge and reason with numbers is to be developed. The child is to be made a thinker as well as a doer; an inventive intelligence rather than a mere arithmetical machine. Theory and practice must, therefore, be united in teaching arithmetic.

This thought-power is developed by the application of numbers to the various practical affairs of life, as well as by the pure science of arithmetic. Each distinct application usually requires some new process of reasoning, as in Interest, Banking, Insurance, etc. All these applications are to be taught intelligently to the student, so that he may understand them independently of the teacher or the text-book. He should be taught the underlying principles of each subject, and he will then be able to devise his own process or rule, and invent the shortest and best methods of solution.

One of the best means of developing the thought-power of the child, is that system of arithmetical reasoning known as "arithmetical analysis." This is a method of reasoning with numbers in which the various relations are determined by a reference to the unit. All numbers and their relations are understood by comparing them through their relation to unity. To and from and around the unit, the current of thought flows. The method is so simple and logical that the ordinary mind can follow it with ease and readily grasp what otherwise would be

complex and difficult. This method of arithmetical analysis is regarded as one of the most important of all the improvements of the New Education. It has been attributed to Pestalozzi, though in its development it is mainly a product of the thought of American teachers. Many of our educators, excepting those who have made a special study of teaching arithmetic, seem not to have understood or appreciated its value; but it is now steadily growing in favor with the leading educators of the country, and its more general introduction into our schools will do much to develop the powers of judgment and reasoning.

It is earnestly recommended that teachers bear clearly in mind the relation of the art to the science of arithmetic; that they drill their pupils until they have acquired facility in the operations of the art; and also that they take special pains to awaken and develop the thought-power of their pupils. Let the object be to make the pupils of our public schools skillful and ready in the practice of arithmetic, and at the same time clear, logical, and independent thinkers.

Primary and Secondary Grades.

GENERAL SUGGESTIONS TO TEACHERS.

The primary and secondary grades embrace the first four years of a child's school life. During this time a thorough foundation in arithmetical knowledge and skill should be laid. A few general suggestions will be given in respect to the course of instruction in these grades and the methods of presenting it.

The Course of Instruction.—The course of instruction during the first four years should be as follows:—

First.—Pupils should attain a clear idea of numbers and the method of expressing them in words and figures.

Second.—They should learn how to unite and separate numbers by the general processes of addition and subtraction, and also by the derivative processes of multiplication and division.

Third.—They should fix in the memory the elementary results of the addition and multiplication tables, and be able to derive the corresponding differences and quotients from these sums and products.

Fourth.—They can also acquire a fair degree of skill in the mechanical operations of the fundamental rules.

Fifth.—Besides this, most of the denominate units can be learned, and a knowledge of the elements of fractions acquired.

Elementary Results.—One of the principal objects of the first two or three years' work is to give pupils clear

ideas of numbers and their relations as expressed by the primary facts of synthesis and analysis. These primary facts or results, as previously explained, must be fixed in the memory, as they lie at the foundation of the science and art of arithmetic. The first object should be to see that the pupils understand the nature and origin of these elementary results. This being assured, they should be led to memorize these elementary results or facts of number. These results or facts should be so thoroughly fixed in the mind that there will be no counting of fingers or marks when adding, or any mistakes or hesitation in the process of multiplying.

For this purpose there needs to be thorough and continued drill upon these primary facts. Pupils should be required to derive, repeat, and write the results until they are known. Intelligent repetition is the only way in which they can be committed to memory. Pupils should say the results and write the results, so that they may be fixed in the mind by both the oral and the visual memory. This repetition should be intelligent, however, and not the mere repeating of unmeaning words.

Fundamental Rules.—During the first four years pupils should acquire a fair degree of skill in the mechanical operations of arithmetic. For this purpose there should be a large amount of drill in the fundamental rules. It requires constant and unremitting labor to attain dexterity and accuracy in adding, subtracting, multiplying, and dividing. These processes are purely mechanical in their nature; but, like playing the piano, familiarity with them is acquired only by long and continued practice. It may seem like a waste of time to devote so much attention to the mechanics of arithmetic, but skill in these operations can be attained in no other way.

Denominate Numbers and Fractions.—During the first four years pupils can become familiar with the ordinary units of the weights and measures and their relation to

one another. Some skill can also be attained in the operations with these units and their practical application. A knowledge of the elements of fractions can also be acquired, including the several operations that pertain to them. The subjects now named are about all that should be embraced in the first four years' course.

The Use of Objects.—Much of this primary instruction should be given objectively. The child's ideas of numbers are most conveniently developed by means of objects. While numbers and things are not identical, the mind is aided in its early numerical ideas and operations by the use of visible and tangible objects. These ideas of numbers are usually developed by the process of "counting." In counting, however, we should not depend on the mere naming of numbers in succession; a child may do this and have no distinct idea of the meaning of the words used. Children are often able to run these words off glibly as far as a hundred and yet be unable to select a dozen objects from a collection. The names of numbers therefore should at first always be associated with the things numbered. The motto should be,—teach numbers rather than figures, ideas rather than abstract words.

The fundamental processes of addition, subtraction, multiplication, and division are also to be taught by means of objects. The child should unite and separate the objects that he may see clearly what is meant by the uniting and the separating of numbers. So strong is this necessity that if the teacher does not require the use of objects the child will count his fingers or use marks on the slate or blackboard, thus showing the natural demand of the mind for the use of concrete things in the primary exercises with numbers.

In teaching the elements of denominate numbers the measures are to be in the school-room for the pupils to handle and see. The "tables" are to be learned, not from the book, but by the use of the measures. In teaching

the elements of fractions also, the ideas are to be made clear to the mind of the learner by concrete illustrations. Concrete objects, and also lines, circles, and squares on the blackboard are to accompany all the elementary exercises in fractions.

In fact, all the processes of primary arithmetic should be illustrated concretely until they are thoroughly understood by the child. This suggestion cannot be too strongly emphasized, and no teacher should neglect it. The objects or "counters" used may consist of blocks, splints, balls, beans, etc. Each pupil should be furnished with a sufficient number of these counters to perform the operations required in each lesson. A numeral frame is an almost indispensable appliance in teaching primary grades. Every primary school in the country should be supplied with a large abacus, such as is usually found in the schools of Europe, and in many of our own schools.

A word of caution may be added,—not to carry the use of objects in arithmetic too far. A child soon learns to think independently of objects, and it is a mistake to fetter the mind with things when it is ready for abstract thoughts. The mind of the child is therefore to be led from the concrete to the abstract as soon as it is ready to make the transition. The teacher will remember that "language is the instrument of thought," and that pupils must be taught to think numerically through the beautiful and ingenious system of arithmetical language. It requires nice judgment on the part of the teacher to see just when the mind of the pupil is ready to dispense with visible or tangible illustrations, and care should be taken not to make the transition too early nor delay it too long.

General Suggestions.—The general order of instruction with young pupils may be indicated as follows: 1st, the operation with objects; 2d, the operation without objects; 3d, the representation of the operations with figures and

other symbols; 4th, the application of the process to concrete examples; 5th, a large amount of practice work for the acquisition of skill in the mechanical operations.

The work of these first four years should be carefully graded. The teacher should always bear in mind that she is dealing with children whose faculties are but slightly developed, and whose comprehension must be constantly aided. The processes should progress no faster than the minds of the learners develop; and concrete problems should be simple, and contain no more steps than the pupil can readily understand. No long and complicated problems should be given to the pupils. The concrete problems in first and second grades should contain only a single step, and those in third and fourth grades not more than two steps.

In the primary grades, especially, give short lessons and proceed slowly. Do not push ahead with the bright pupils who learn easily, and thus neglect the dull and slow pupils. Teach each individual of the class, and take special pains to stimulate the inattentive and backward pupils and to insure their progress day by day, that they may not drop behind the class so that the advancing instruction shall be lost to them.

For this purpose the classes should be divided into sections and each section taught separately. It is only in this way that each pupil can receive a proper share of attention. While one section is having an exercise with the teacher, the other sections may be doing written work in review of the previous exercises. There are many exercises, however, such as reviews and class drills, in which the entire class may be taught together.

Oral exercises, with small numbers, are to be given regularly in connection with the written work. Such exercises are useful both for rapid computation and illustration of principles and processes. A new process will be more readily seen by the use of small numbers than by large

ones. Besides the ability to reckon quickly "in the head" is valuable in the practical affairs of life.

In the processes of the fundamental operations, no rules are to be studied and committed to memory. Each process is to be illustrated and explained so that the pupils have an intelligent idea of it, and then they are to be drilled in doing the work until the process is fixed in the mind, and skill and accuracy are attained.

The written work on the board or slate or paper should be neat and in proper form. No carelessness in this respect should be permitted. The figures and signs should be carefully and neatly made, and all the work should express just what is intended to be expressed. Remember that accuracy of expression begets accuracy of thought.

Care should be taken that in all the exercises the language of the pupil is both correct and appropriate. The lesson in arithmetic affords an excellent opportunity for elementary exercises in language culture. The teacher must be careful, however, not to make these exercises formal and unnatural. No fixed forms of analysis or explanation which the pupils are required to commit to memory should be allowed. Such a practice begets the habit of using words without ideas, which should be carefully guarded against in the education of children. While there are some elementary thought-forms and forms of expression which the pupils will readily acquire, this is quite different from committing to memory set forms of reasoning or explanation.

Other suggestions will be presented in connection with the course of study in each of the several grades.

THE COURSE OF INSTRUCTION FOR PRIMARY AND SECONDARY GRADES.

FIRST GRADE—*Time, five months.*
Numbers from One to Ten, inclusive.

I. THE COURSE OF INSTRUCTION.

1. Ideas of numbers as far as *ten*.
 - (a) Their names.
 - (b) The figures.
2. Addition and subtraction as far as *ten*.
 - (a) With objects.
 - (b) Without objects.
 - (c) With figures.
3. Multiplication and division as far as *ten*.
 - (a) With objects.
 - (b) Without objects.
 - (c) No inexact division.
4. Signs of operation.
+, —, and =

II. METHODS OF TEACHING THE COURSE.

1. Use objects in teaching the ideas and names of numbers.
2. Use objects in obtaining the "facts" of numbers.
3. Teach addition and subtraction together.
4. Teach multiplication and division together.
5. Do not combine the four processes at first.

6. Have no exercises in inexact division in this grade.
7. In this grade have but one class of problems in division; as "how many 3's in 6?"
8. Take special pains to have pupils first *understand* and then *fix in the memory* the elementary *sums* and *products*.
9. Have the pupils work out the "facts" with objects repeatedly, and also try to fix these facts in their minds by proper drilling.
10. Have pupils *see* the results and *say* the results, that they may learn them by both the visual and the verbal memory.
11. Do not allow any concert exercises in which pupils merely repeat results or processes without reference to objects.
12. Introduce the symbols $+$, $-$ and $=$ as they are needed and as substitutes for the words "and" or "added to," "less," etc. Do not introduce $\times$ and $\div$ in this grade.
13. Have written exercises in addition and subtraction; but no written exercises in multiplication or division in this grade.
14. Lead to the idea of multiplication by combining equal numbers, and to the idea of division by separating into equal numbers.
15. Besides the objects or "counters," make use also of such objects in the school-room as windows, doors, slates, desks, pictures, and also the parts of the body, as the eyes, hands, fingers, etc.
16. As soon as children can draw a little, have them illustrate the processes with simple pictures.
17. Teachers will be careful to distribute the work properly through the five months. Have no "more or less" examples in this grade. Use only two numbers in any exercise, except in deriving an elementary product or quotient.

18. Have pupils tell little "number stories" with the processes of addition and subtraction, but do not carry this exercise to excess.

19. Teachers will exercise their ingenuity in devising means to give variety to their methods of instruction.

20. Written work like the following affords a good exercise for this grade:—

4	5	6	7	8	9	10
2+2	2+3	3+3	6+1	6+2	7+2	6+4
3+1	4+1	2+4	5+2	5+3	5+4	8+2
1+3	3+2	5+1	4+3	4+4	6+3	7+3

Write the large figure and have the children write the parts below it.

SECOND GRADE.—*Time, five months.*

Numbers from One to Twenty, inclusive.

I. THE COURSE OF INSTRUCTION.

- Ideas of numbers as far as *twenty*.
 - Their names.
 - Expression in figures.
- Addition and subtraction as far as *twenty*.
 - With objects.
 - Without objects.
 - With figures.
- Multiplication and division as far as *twenty*.
 - With objects.
 - Without objects.
 - With figures.
 - No inexact division.
- Signs of operations.

+, −, ×, ÷, =.

5. Denominate numbers.
 - (a) Value:—1 cent, 1 dime.
 - (b) Length :—1 inch, 1 foot.
 - (c) Volume:—1 pint, 1 quart.
6. Fractional parts : one-half, one-fourth.
 - (a) Equal parts of a unit.
 - (b) Equal parts of numbers.
 - (c) No inexact fractional parts.
7. Simple exercises in concrete problems.

II. METHODS OF TEACHING THE COURSE.

1. Follow the directions given for the first grade.
2. Review the work of the first grade. Distribute the work carefully throughout the term.
3. Introduce the signs of multiplication and division, $\times$ and $\div$, in the second grade.
4. In this grade introduce both classes of problems in division; as "how many 4's in 8?" and "divide 8 into two equal parts," or "find one-half of 8."
5. In naming numbers from *ten* to *twenty* :—
 - (a) Form a group of ten objects, and combine with this group, *one, two, three*, etc.
 - (b) Require pupils to count "one and ten," "two and ten," "three and ten," etc., as far as "two tens."
 - (c) When pupils are familiar with these expressions (which show the principle of naming numbers), the common words, *eleven, twelve*, etc., may be used.
6. In writing numbers from *ten* to *twenty* :—
 - (a) Show the principle of notation somewhat as follows:—

That 15 expresses "5 and 10" : 12 expresses "2 and 10"
 14 " "4 and 10" : 11 " "1 and 10"
 13 " "3 and 10" : 10 " "0 and 10"
 or simply 10.

(b) When pupils are familiar with these expressions (which show the principle of writing numbers), lead them to use the common words, *ten*, *eleven*, *twelve*, etc.

7. Have pupils write the elementary results in the form of tables, thus:—

$$\begin{array}{llll} 1 + 1 = 2 & 9 - 1 = 8 & 2 \times 1 = 2 & 2 \div 1 = 2 \\ 1 + 2 = 3 & 8 - 2 = 6 & 2 \times 2 = 4 & 4 \div 2 = 2 \\ 2 + 3 = 5 & 7 - 4 = 3 & 2 \times 3 = 6 & 6 \div 3 = 2 \end{array}$$

8. Have written work also in the following form:—

$$\begin{array}{r} 4 \\ + 2 \\ \hline \end{array} \quad \begin{array}{r} 8 \\ - 5 \\ \hline \end{array} \quad \begin{array}{r} 6 \\ \times 2 \\ \hline \end{array} \quad \begin{array}{r} 2) 8 \\ \hline \end{array}$$

9. In teaching denominate numbers, show the pupils the real measures:—cent, dime, inch, foot, pint, etc.

10. In teaching fractional parts, use objects, circles, squares, pieces of paper, groups of objects, etc.

11. Drill the pupils on the elementary *sums* and *products* within the limits of twenty, until they are fixed in the memory.

12. Do not allow concert exercises in which pupils merely repeat processes or tables without reference to objects.

13. Have pupils derive the "elementary differences" from the "elementary sums" and the "elementary quotients" from the "elementary products."

14. Use only two numbers in any exercise except in obtaining an elementary product or quotient. Have no exercises of inexact division or of inexact fractional parts of numbers in this grade.

15. Have pupils illustrate the processes with little pictures on the slate and blackboard.

16. Have pupils tell little "number stories" with the processes, but do not carry the exercise to excess.

17. In concrete problems have oral and written work in addition and subtraction, but only oral work in multiplication and division. Have no written work in fractions in this grade.

18. Use concrete illustrations as far as necessary, but do not continue to illustrate when no illustration is needed. Lead the mind of the child from the concrete to the abstract.

19. Have pupils analyze numbers into their parts, by the four processes. Thus take the number 8;—

$$\begin{array}{llll} 8 = 6 + 2 & 8 - 5 = 3 & 8 = 4 \times 2 & 8 \div 4 = 2 \\ 8 = 5 + 3 & 8 - 2 = 6 & 8 = 2 \times 4 & 8 \div 2 = 4 \end{array}$$

20. An exercise in filling out blanks like the following will be found useful:—

$$\begin{array}{llll} 4 + ? = 6 & 8 - ? = 5 & 3 \times ? = 6 & 8 \div ? = 4 \\ 3 + ? = 8 & 10 - ? = 5 & 4 \times ? = 12 & 10 \div ? = 2 \end{array}$$

NOTE.—To teach the naming and the writing of numbers, teachers need a few hundred splints or toothpicks or other objects and a few elastic bands.

THIRD GRADE.—*Time, five months.*

I. THE COURSE OF INSTRUCTION.

I. *Elementary results with numbers as far as fifty.*

1. Ideas of numbers as far as *fifty*.

- (a) Naming the numbers.
- (b) Expressing the numbers by figures.
- (c) Roman numerals to ten.

2. Addition and subtraction as far as 50.
 - (a) Orally (with and without objects).
 - (b) With figures.
 - (c) Commit elementary sums to 20.
 - (d) Derive sums beyond 20 from elementary sums.
3. Multiplication and division as far as 50.
 - (a) Orally (with and without objects).
 - (b) With figures.
 - (c) Commit elementary products to 50.
 - (d) Derive elementary quotients from elementary products.
 - (e) Simple exercises in inexact division to 20.
4. Simple oral and written exercises in concrete problems, no number or result to exceed fifty.

II. *Elements of denominate numbers and fractions.*

1. Denominate numbers.
 - (a) Value—coins from 1 cent to 1 dollar.
 - (b) Length—inch, foot, yard.
 - (c) Measures—pint, quart, gallon.
 - (d) Measures—pint, quart, peck.
2. Fractional parts, $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, and $\frac{1}{16}$.
 - (a) Equal parts of a unit.
 - (b) Equal parts of numbers.
 - (c) No inexact fractional parts.
 - (d) The work both oral and written.
3. Simple exercises in denominate numbers and fractions, both oral and written.

III. *Written work in the fundamental rules.*

1. Numeration and notation to a hundred.
 - (a) Naming numbers.
 - (b) Writing numbers.

2. Exercises in addition to one hundred.

(a) Add numbers of one term to numbers of two terms.

(b) Add single columns within the limit.

(c) Add two or more numbers of two terms.

3. Exercises in subtraction to one hundred.

(a) Subtract numbers of one term from numbers of two terms.

(b) Subtract numbers of two terms from numbers of two terms.

NOTE.—Limit the oral work and the concrete exercises in the fundamental rules to fifty.

II. METHODS OF TEACHING THE COURSE.

1. Follow the directions, which are applicable, given under the previous grades.

2. Review the work of previous grades. Be careful to distribute the work properly throughout the term.

3. Use sticks and other objects to form bunches or groups of tens, in obtaining the ideas and names of numbers up to one hundred.

4. In teaching pupils to name numbers up to 100, be careful to bring out the idea of groups, by naming numbers at first as follows:—

Two tens and one,	Three tens,	Four tens,
two tens and two,	three tens and one,	four tens and one,
etc., etc.	etc., etc.	etc., etc.

When this is clearly understood, then use the ordinary names, twenty-one, twenty-two, thirty, etc.

4. In teaching pupils to write numbers up to 100, be careful to bring out the idea of place value; that is that 35 is "3 tens and 5," 46 is "4 tens and 6," etc.

5. Drill the pupils until they know the "elementary sums" as far as "10 and 10 are 20."

6. Drill the pupils until they know the "elementary products" as far as 50. Derive the elementary quotients from the elementary products.

7. The sums of numbers beyond "10 and 10" are not to be committed to memory, but are to be derived by means of the "elementary sums."

8. Do not allow pupils to sing the multiplication table nor to repeat it in concert. Have each pupil make it, write it, study it, and recite it.

9. Require neat and accurate work. Do not allow children to make such mistakes in writing their work as $5 \div 2 = 2 + 1$.

10. In deriving the sums of numbers beyond "10 and 10," have the pupils think through the decimal system and the Arabic notation. The method of doing this is indicated in the next suggestion.

11. In adding numbers of one figure to numbers of two figures, take examples first where there is no "carrying," regularly graded, as 13 and 5, 23 and 5, 32 and 5, etc.; 12 and 6, 22 and 6, 32 and 6, etc.

Then take examples where there is "carrying," as 15 and 8, 25 and 8, 35 and 8, etc. Do these exercises with figures, and also orally.

12. In subtracting numbers of one term from numbers of two terms, take examples first in which there is no "borrowing," regularly graded, as 16 less 4, 26 less 4, 36 less 4, etc.

Then take examples where there is "borrowing," as 23 less 6, 33 less 6, 43 less 6, etc. Do these exercises with figures, and also orally.

13. In finding the "elementary results," teach addition and subtraction together, and also multiplication and

division together; but in the "fundamental rules" teach the four processes separately.

14. Teachers will exercise good judgment in combining properly the oral and the written work. Drill pupils on the written work to secure skill in the mechanical operations.

15. Have pupils invent concrete problems from written work placed on the board, thus:—

$8 + 2$ (problem) 4×3 (problem) $\frac{1}{2}$ of 12 (problem)
 $7 - 3$ (problem) $12 \div 4$ (problem) $5 + 3 - 2$ (problem)

16. In teaching fractional parts, use objects, circles and squares made of paper, and circles, squares and lines on the blackboard, etc.

17. In obtaining fractional parts, restrict the work to *one* of each of the equal parts, as *one-third* of 6, *one-fourth* of 8, etc.

18. In concrete problems have but two steps in problems involving addition and subtraction, and but one step in problems involving multiplication or division.

FOURTH GRADE.—*Time, five months.*

THE COURSE OF INSTRUCTION.

I. *Elementary results with numbers up to one hundred.*

1. Ideas and names of the numbers.
 - (a) Naming and writing the numbers.
 - (b) Roman numerals to fifty.
2. Addition and subtraction as far as one hundred.
 - (a) With figures.
 - (b) Without figures.
 - (c) Derive sums beyond 20 from elementary sums.

3. Multiplication and division as far as one hundred.
 - (a) Orally (with and without objects).
 - (b) With figures.
 - (c) Commit elementary products to 100.
 - (d) Derive elementary quotients from elementary products.
 - (e) Simple exercises in inexact division.
4. Simple concrete exercises, both oral and written, no number or result to exceed one hundred.

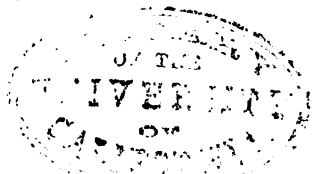
II. *Elements of denominate numbers and fractions.*

1. Denominate numbers.
 - (a) Review the previous grades.
 - (b) Weight:—ounce, pound.
 - (c) Time:—day, week, month, year, hour, minute, second. Teach time from the clock.
 - (d) Counting:—dozen, score.
2. Fractional parts as far as one-tenth.
 - (a) Equal parts of a unit.
 - (b) Equal parts of numbers.
 - (c) No inexact fractional parts.
 - (d) Illustrate with lines, circles, squares, etc.
3. Simple exercises in denominate numbers and fractions, both oral and written.

NOTE.—Give only one number in changing to higher or lower denominations, and have no inexact divisions. Use the "analytic form" of solution.

III. *Written work in fundamental rules.*

1. Numeration and notation.
 - (a) Naming numbers to 1000.
 - (b) Writing numbers to 1000.



2. Written addition.

- (a) Add single columns, the sum within 100.
- (b) Add columns of two and three terms, within the limit.

3. Written subtraction.

- (a) Subtract numbers of two and three terms in which no term of the subtrahend exceeds the corresponding term of the minuend.
- (b) Subtract numbers of two and three terms in which a term of the subtrahend exceeds the corresponding term of the minuend.

4. Written multiplication.

- (a) Multiplicand two and three terms, multiplier one term, and no "carrying."
- (b) Multiplicand two and three terms, multiplier one term, and when there is "carrying."

5. Written division.

- (a) Dividend two and three terms, divisor one term, and no partial remainders.
- (b) Dividend two and three terms, divisor one term, and with partial remainders.

NOTE.—Limit the work in concrete problems, written as well as oral, to numbers not exceeding one hundred; also, to two steps in problems involving addition and subtraction, and to two steps in problems involving multiplication and division, one of these being addition or subtraction.

II. METHODS OF TEACHING THE COURSE.

1. Follow the directions under the previous grades which are applicable to the exercises of this grade.

2. In naming numbers do not neglect to use objects to illustrate the grouping by tens and hundreds.

3. Be sure the pupils know the elementary sums, and can use them in deriving the sums of larger numbers.

4. Be sure the pupils know the elementary products as far as "10 times 10." Have them understand, make and commit the multiplication table.

5. Be sure that pupils know how to derive the "elementary quotients" from the "elementary products."

6. The teacher will combine the oral and written exercises with careful judgment.

7. In the written work, take pains to secure neatness in writing and accuracy in results.

8. In the oral exercises in addition and subtraction beyond 10, train the pupils so that they may work with both the *visual* and the *oral* language.

9. The sums of numbers beyond 9 and 9 (or 10 and 10) need not be committed to memory, but are to be derived by means of the "elementary results."

10. In the concrete problems, use small numbers so as not to require much mental effort in the mechanical operations.

11. In the exercises in "fractional parts," restrict the work to *one* of each of the fractional parts, as one-fifth of 15, one-sixth of 24, etc.; also, to "elementary products" not exceeding 100.

12. Do not allow pupils to repeat the addition and multiplication tables in concert, or to sing them.

FIFTH GRADE.—*Time, five months.*

I. THE COURSE OF INSTRUCTION.

1. *Numeration and notation.*

(a) Writing and reading numbers to *five places*.

(b) Places of units, tens, hundreds, etc.

(c) Roman notation, to one hundred.

II. Fundamental operations.

1. Addition.

- (a) Rapid oral addition properly graded.
- (b) Written exercises of two, three, and four terms.
- (c) Concrete problems, oral and written.
- (d) Introduce the terms *addition* and *sum*.

2. Subtraction.

- (a) Rapid oral subtraction properly graded.
- (b) Written exercises as far as four places.
- (c) Concrete problems, oral and written.
- (d) Introduce the terms *subtraction*, *minuend*, *subtrahend*, and *difference* or *remainder*.

3. Multiplication.

- (a) The elementary products to "12 times 12."
- (b) Multiplier of one and of two terms.
- (c) Concrete problems, oral and written.
- (d) Introduce the terms *multiplier*, *multiplicand*, and *product*.

4. Division.

- (a) Drill on elementary quotients.
- (b) Exercises in inexact division.
- (c) Short division, no divisor exceeding 12.
- (d) Long division, no divisor exceeding 50.
- (d) Concrete problems, oral and written.
- (e) Introduce the terms, *divisor*, *dividend*, *quotient*, and *remainder*.

NOTE.—In the oral exercises do not extend the work beyond 144. In concrete problems limit the work to three steps in problems involving addition and subtraction, and to two steps in problems involving multiplication and division.

III. *Denominate numbers.*

1. Review the measures of the previous grades.
2. Write and commit the tables of:—
 - (a) United States money.
 - (b) Dry measure.
 - (c) Liquid measure.
 - (d) Avoirdupois weight.
3. Simple exercises in changing to lower or higher denominations.

NOTE.—Limit the work to two denominations. Use the “analytic form” of written work. The measures will include bushels, gallons, tons, and the lower denominations; and in United States money, dollars and cents and the ordinary coins.

IV. *Common fractions as far as tenths.*

1. Write and read fractions.
2. Exact fractional parts of numbers.
3. Concrete problems involving fractional parts.
4. Illustrate with lines, circles, squares, objects, etc.

II. THE METHODS OF TEACHING THE COURSE.

1. Review the work of the previous grades.
2. Be sure that pupils know the elementary results of the “addition table.”
3. Have frequent drills in the “multiplication table,” and be sure that every pupil knows it.
4. Do not allow pupils to repeat the addition and multiplication tables in concert, or to sing them.
5. Have frequent oral exercises to secure rapidity and accuracy in the fundamental operations.
6. Oral exercises with small numbers should accompany all the written work.

7. Explain the reason for "carrying" in addition and multiplication and of "borrowing" in subtraction.

8. Take pains also to see that the steps in multiplication and division are understood.

9. The teacher will exercise ingenuity in devising methods of drill that will give variety and interest to the work.

10. The teacher will be careful to grade the exercises so as to adapt them to the knowledge and progress of the pupils.

11. In "long division" let the right digit of the divisor, at first, be small; as 13, 14, 21, 22, 23, 31, 32, 33, 41, 42, etc.

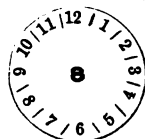
12. Have the weights and measures in the school-room to illustrate denominate numbers; and use objects, circles, squares, lines, etc., to illustrate fractions.

13. Illustrate concretely wherever such illustrations are applicable and useful. Do not hold the mind down to the concrete too long, but gradually lead to the abstract conception of the subject.

14. The exercises in fractions are to include no inexact fractional parts of numbers, and are to be *oral* and *written*. In this grade they should extend to more than one of the equal parts, as two-thirds of 12, three-fourths of 16, etc. All exercises limited to elementary results not exceeding 100.

15. Do not teach the definitions of the terms introduced, but lead the pupils to see their meaning by their use.

16. The teacher should exercise ingenuity in giving variety and interest to the drill in numbers. To illustrate, draw a circle on the board and write the digits in order from 1 to 12 as on the dial of a clock. Then write any number as 8 at the centre and require the pupils to begin at some



point and add 8 to the numbers in order around the circle. Have them also add 10 to the first number and obtain two sums, as follows:—One pupil says, “4 and 8 are 12, 14 and 8 are 22.” The next pupil says, “5 and 8 are 13, 15 and 8 are 23.” Require the pupils to keep the run of the exercise, so that the teacher need not indicate whose turn it is next. Devices like this, many of which the ingenious teacher will readily invent, give great interest to the mechanical drill.

17. The teacher will exercise ingenuity in making problems and in asking questions so as to cultivate the power of thought on the part of the pupils.

18. Do not teach “rules,” but drill upon the *methods of operation* until they are understood and permanently acquired.

SIXTH GRADE.—*Time, five months.*

I. THE COURSE OF INSTRUCTION.

1. *Numeration and notation.*

- (a) Writing and reading numbers to *six places*.
- (b) Exercises in Roman notation to five hundred.

II. *Fundamental operations.*

1. Addition.

- (a) Rapid addition properly graded.
- (b) Adding numbers within the limit.

2. Subtraction.

- (a) Subtracting numbers within the limit.
- (b) With one or more ciphers in the minuend.

3. Multiplication.

- (a) With two and three terms in the multiplier.
- (b) With one or more ciphers in the multiplier.

4. Division.

- (a) Short division in review.
 - (b) Long division, divisor not to exceed two figures.
 - (c) With one or more ciphers in the quotient.
5. Application of each to concrete problems.
6. Oral and sight exercises for rapidity and accuracy.

III. *United States money.*

1. Write and read United States money.
2. Addition and subtraction.
3. Multiplication and division.
4. Practical problems in United States money.

NOTE.—The divisor in this grade to be abstract.

IV. *Denominate numbers.*

1. Review measures of previous grades.
2. Write and commit the measures of:—
 - (a) Length :—inch, foot, yard, rod, mile.
 - (b) Time :—second, minute, hour, day, week, month, year, century.
 - (c) The number of days in each month.
3. Simple exercises in changing to lower or higher denominations.

NOTE.—Limit the work to two denominations. Use the "analytic form" of written work. Do not use $5\frac{1}{2}$ in the operations.

V. *Common fractions as far as twelfths.*

1. Write and read fractions.
2. Exact fractional parts of numbers.
3. Simple concrete problems with fractional parts.

VI. *All necessary terms to be learned as needed.*

II. METHODS OF TEACHING THE COURSE.

1. Oral exercises in addition, subtraction, multiplication, and division.

2. Be sure that pupils know the elementary results of the addition table.

3. Have frequent drills on the multiplication table, and be sure that every pupil knows it. No concert exercises.

4. Do not permit the method of "long division" with a divisor of 12 or less.

5. Aim to make pupils quick and accurate in the fundamental rules.

6. No rules need be learned, but the pupils are to be drilled on the processes until they are familiar with them.

7. Awaken a spirit of emulation in respect to rapid and accurate work in the mechanical operations.

8. Exercise ingenuity in originating methods and devices that will give variety and interest to the mechanical work.

9. Illustrate fractions with objects, circles, squares, etc. Illustrate with concrete objects all such subjects as illustrations will simplify.

10. Explain the reasons for the various operations so far as they can be understood by pupils.

11. Have pupils invent problems for one another and solve one another's problems.

12. Have the units of length, inch, foot, yard and rod, represented concretely. The length of the rod can be marked off on the walls or the floor.

13. Have pupils measure the length of objects in the school-room, and also estimate lengths, heights, and distances, in feet, yards, etc.

14. Have pupils handle and estimate the weight of small objects in ounces and of larger objects in pounds and parts of pounds.

15. Have pupils estimate the contents of vessels in pints, quarts, gallons, pecks, etc. Give them concrete and practical ideas of all these measures.

16. The exercises in fractions are to be restricted to exact fractional parts, and are to be *oral* and *written*. They should extend to more than one of the equal parts, as 3-fourths of 16, 4-fifths of 20, etc. All exercises in fractions limited to elementary results not exceeding 144.

17. The practical examples should not include large numbers.

SEVENTH GRADE—*Time, five months.*

I. THE COURSE OF INSTRUCTION.

I. *Numeration and notation.*

1. Read and write numbers to *seven places*.

2. Practice in Roman notation to one thousand.

II. *Fundamental rules.*

Addition and subtraction.

- (a) Rapid addition of columns.
- (b) Add and subtract numbers within the limit.

2. Multiplication.

- (a) With three and four terms in multiplier.
- (b) With ciphers at the right of multiplier and multiplicand.

3. Division.

- (a) Divisor of two and three terms.
- (b) With ciphers at right of divisor and dividend.
- (c) Write the remainder in the form of a fraction.

4. Practical problems in fundamental rules.

5. Oral and sight exercises for rapidity and accuracy.

III. *United States money.*

1. Addition and subtraction.

2. Multiplication and division.

3. Simple problems in business transactions.

NOTE.—The divisor may be dollars, cents, etc.

IV. *Denominate numbers.*

1. Review previous measures.

2. Teach the following measures :—

- (a) Counting :—dozen, gross, score.
- (b) Surfaces :—square inch, square foot, square yard.

3. Reduction of denominate numbers.

- (a) Descending, simple exercises.
- (b) Ascending, simple exercises.

V. *Common fractions to twentieths.*

1. Write and read fractions.
2. Find exact fractional parts of numbers.
3. Simple concrete problems with fractions.
4. Reduction of fractions.
 - (a) Mixed numbers to improper fractions.
 - (b) Improper fractions to whole or mixed numbers.
 - (c) To larger terms.
 - (d) To smaller terms.

VI. *Arithmetical analysis.*

1. Pass from the unit to a collection.
2. Pass from a collection to the unit.
3. Pass from a collection to a collection.
4. Simple problems in addition and subtraction.

VII. *All necessary terms to be learned as needed.*

II. METHODS OF TEACHING THE COURSE.

1. Follow the suggestions of previous grades as far as they apply.
2. Have oral exercises with small numbers to accompany all the written work.
3. Have frequent drills on the multiplication table and be sure that every pupil knows it. No concert exercises.
4. Make the work in denominate numbers as concrete and practical as possible.
5. Drill on the fundamental rules as far as is necessary to insure rapidity and accuracy.
6. Illustrate the exercises in fractions with objects, circles, lines, squares, etc. Limit the exercises in fractions to small numbers.

7. Let the concrete work be related to practical life, the problems, as far as possible, being such as occur in the home, the shop, the store, etc.

8. The exercises in the reduction of denominate numbers should be simple, involving integers only. They should extend to three denominations. Both forms of written work, the "analytic" and the "operation," should be taught. Do not use $5\frac{1}{2}$ in these operations.

9. In this grade is first introduced "arithmetical analysis," which is regarded as the key to arithmetical reasoning. Much of the work up to this time has been mechanical, involving some judgment but little reasoning. These exercises will train the mind to logical habits of operating with numbers.

10. The exercises in analysis are indicated by such examples as the following:—

(a) If one orange costs 4 cents what will 3 oranges cost?

(b) If 3 oranges cost 12 cents what will one orange cost?

(c) If 4 oranges cost 24 cents what will 5 oranges cost?

11. The following suggestions are given for the work in "arithmetical analysis:"—

(a) The exercises should involve only small numbers so that the mind may be concentrated upon the thought.

(b) The thought should be simple, direct, and logical. The language will then also be simple and logical.

(c) While the thought must be determined by the language, teachers will be careful that the pupils think and express their thoughts, rather than merely go through a formula of expression mechanically.

NOTE.—The exercises in arithmetical analysis should be oral.

EIGHTH GRADE.—*Time, five months.*

I. THE COURSE OF INSTRUCTION.

I. *Notation and numeration.*

1. Write and read numbers to *eight places*.
2. Review Roman notation.

II. *Fundamental rules.*

1. Oral exercises for rapidity and accuracy.
2. Drill on the fundamental rules.
3. Require reasons for the different processes.
4. Concrete problems in fundamental rules.

III. *Factors, divisors, and multiples.*

1. Prime and composite numbers.
2. Principle of divisibility by 2 and 5.
3. Resolving numbers into their factors.
4. Greatest common divisor, by factoring.
5. Least common multiple, by factoring.

IV. *United States money.*

1. Review previous grade.
2. Practical business transactions.
3. Compute and make out bills.

V. *Denominate numbers.*

1. Review previous measures.
2. Teach the following measures:—(a) Solids: cubic inch, cubic foot, cubic yard.

3. Reduction, descending and ascending.
4. Addition and subtraction.
5. Multiplication and division.

NOTE.—These exercises should involve integers only, and should not extend beyond three terms. The divisor to be abstract.

VI. *Common fractions.*

1. Reduction of fractions.
 - (a) Mixed numbers to improper fractions.
 - (b) Improper fractions to whole or mixed numbers. /
 - (c) To larger terms.
 - (d) To smaller terms.
 - (e) Parts of fractions.
2. Addition and subtraction.
 - (a) Denominators alike.
 - (b) Denominators unlike.
3. Multiplication.
 - (a) Fraction by an integer.
 - (b) Fraction by a fraction.
4. Division.
 - (a) Fraction by an integer.
 - (b) Fraction by a fraction.

NOTE.—In the exercises in fractions, no term of a given fraction is to exceed two figures; only simple fractions, with no term exceeding 20, are to be used in the operations of adding, subtracting, multiplying, and dividing. Not more than two fractions are to be used in the operations of adding, subtracting, multiplying, and dividing.

VII. *Arithmetical analysis.*

1. Pass from a number to a number.
2. Pass from a unit to a fraction.

3. Pass from a fraction to a unit.
4. Pass from a number to a fraction.
5. Pass from a fraction to a number.

VIII. *Necessary terms to be learned as needed.*

II. METHODS OF TEACHING THE COURSE.

1. Apply suggestions of previous grades so far as practicable.

2. Oral exercises with small numbers should accompany all the written work.

3. Give as much time to the fundamental rules as is necessary to insure rapidity and accuracy.

4. Have frequent drills on the tables, and see that every pupil knows them. No concert exercises.

5. Be sure that pupils can divide by short and long division up to the limit.

6. In denominate numbers be sure that the pupils have real, definite, and practical ideas of the measures and their uses.

7. In the reduction of denominate numbers, teach both forms of written work, the "analytic" and the "operation."

8. Illustrate the exercises in fractions with objects, and also with circles, lines, squares, etc., made of paper, and on the blackboard.

9. Let all the concrete work be related, as far as possible, to practical life, the problems being such as may actually occur in the school-room, household, store, shop, etc.

10. Have the pupils exercise their ingenuity in inventing problems, and also in originating solutions.

11. The exercises in factoring, common divisor, and common multiple should be restricted to numbers not exceeding 144.

12. Under arithmetical analysis, review the previous grades before beginning the exercises of this grade. Remember, also :—

(a) That the numbers should be small, so that the mind may be concentrated upon the thought.

(b) That the forms of thought should be simple, direct, and logical; and that the expression should be a reflection of the thought.

(c) Let the problems be properly graded, beginning with simple combinations and proceeding gradually to more complex ones.

(d) If any pupils do not seem to understand the analysis, lead them step by step to the form of thought by simple questions.

13. The exercises in analysis are indicated by such questions as the following :—

(a) If a yard of silk cost \$6, what will $\frac{2}{3}$ of a yard cost?

(b) If $\frac{2}{3}$ of a yard of silk cost \$4, what will 1 yard cost?

(c) If 2 yards of silk cost \$12, what will $\frac{2}{3}$ of a yard cost?

(d) If $\frac{2}{3}$ of a yard of silk cost \$4, what will 2 yards cost?

14. The exercises in arithmetical analysis should at first be given orally, but later in the term they may also be written. The “analytic form” of writing is preferred.

The Grammar Grades.

GENERAL SUGGESTIONS TO TEACHERS.

The Grammar grades embrace the second four years of a pupil's school life. In these four years the subject of arithmetic is to be continued until it covers the most important business applications of the science. A few general suggestions will be given in respect to the methods of instruction in these grades, following which the course of study will be presented in detail.

1. The teacher will bear in mind that the object of the study of arithmetic is twofold—the development of mental power and the acquisition of skill in the use of numbers. The study of arithmetic is especially adapted to strengthen the mind and to cultivate the powers of attention, judgment, and reasoning. Skill in the use of numbers involves both the power to reason and facility and accuracy in the mechanical operations.

2. In the lower grades special pains were taken to secure facility in performing the various mechanical operations. This is the first requisite of an arithmetician. Such skill requires practice and is readily acquired in youth. In teaching arithmetic, difficult explanations are to be deferred until this mechanical skill is secured and the mind is sufficiently mature for the reasoning processes of the science. In the grammar grades, while drill exercises in the mechanical operations should be continued, more attention should be given to the reasoning powers of

the pupils. The teachers should aim to make of their pupils intelligent and independent thinkers.

3. Pupils in these grades should be gradually trained to depend upon themselves in their arithmetical work. In the previous grades the pupil has depended largely upon the teacher to aid him in understanding a subject; he should now begin to learn to depend more upon himself. The teacher will, therefore, exercise careful judgment to know just now far to throw the pupil upon his own responsibility. In presenting a new subject somewhat difficult, the teacher should explain it fully and clearly; when the subject is less difficult, a partial explanation or some suggestive questions will suffice, the pupil being required to work out the rest for himself. Subjects should often be assigned for pupils to prepare and bring to the recitation and thus show that they have made the preparation. The more a pupil does for himself the more power to do he acquires.

4. With this end in view, some home work or work outside the recitation, should be required in arithmetic. Certain subjects or problems under a subject, should be assigned for the pupil to prepare out of school hours, or when not reciting. This will not only cultivate industrious habits, but it will also serve to give the pupil confidence in his own ability to overcome difficulties without the assistance of the teacher. A sense of self-reliance and a spirit of ambition will be aroused that will prove of great advantage in after life.

5. Great care should be taken that all the work be properly graded. The difficulty pupils experience in arithmetic is often due to the large step between one subject and another. Where the exercises are so related that one point prepares the way for another, the work is usually easy and interesting. The teacher will, therefore, take great pains to see that the transitions in the different

lessons and exercises are natural and easy. In arithmetic, especially, each subject learned should be made a stepping-stone to the one that follows.

6. In entering upon a new subject, care should be taken that the pupil has a clear and definite conception of it. He should have a clear idea of its object, the meaning of its terms, and the practical business transaction of which it treats. The difficulty often experienced by pupils with a subject is due to their not understanding the terms used and the nature and object of the transaction involved. This is especially the case in the business applications of arithmetic which constitute so large a portion of the study to-day. Thus in Banking, Insurance, Discounting, etc., the main difficulty with the pupil consists in obtaining a definite idea of what these business operations actually are. The teacher should therefore take special pains to see that the language and nature of the subject under consideration are clearly understood.

7. Oral and written exercises should be combined at nearly every step of the work. Every subject should be first illustrated with oral exercises by the use of small numbers before the written work is attempted. Small numbers used orally enable the mind to be wholly concentrated upon the new idea or process, and thus the way is prepared for dealing with large numbers. These oral exercises, it will be noticed, are not necessarily, as is often supposed, identical with what is called arithmetical analysis.

8. Care should be taken also not to give long and complicated problems. The principle of a subject is exemplified in a short problem just as clearly as in a long one; and when the numbers are large and the conditions numerous the mind is led away from the principle by the labor of the mechanical operations. Large numbers may

be useful in acquiring mechanical skill in the fundamental rules; but they distract the mind of the pupil in the investigation of a new subject. Teach the new principle or method through the use of small numbers so that the mind may be concentrated upon it rather than upon the mechanical operations.

9. Pupils should gradually be required to give logical explanations of their work in the grammar grades. In the lower grades the teacher was satisfied if the child could do the work and if, by the answer of questions, he seemed to understand it. In the grammar grades the pupil should begin to express in a more formal and logical way his reasons for the various methods and operations. It is not only important to think but also to be able to express thought. Explanations both oral and written should therefore be combined with the operations.

10. These explanations, or "solutions," should be simple, direct, and logical. There is a simple way of thinking upon arithmetical subjects, and the pupil should acquire this simple and logical way of thinking. Taught to think in this way, the expression of thought will also be orderly, simple, and logical. The awkward habits of thought and expression that pupils often employ in discussing arithmetical subjects, are to be severely condemned. The wordy explanations that talk round and about a subject instead of saying just what is necessary to a clear conception of it, are pernicious in mental discipline. It is suggested, therefore, that careful attention be given to train pupils to simple and logical forms of thought and expression.

11. Under this head it may be well to guard teachers against permitting pupils to commit and repeat long explanations of problems or demonstrations of principles as given in a text-book. This would be to substitute language for thought, a most pernicious habit in education. The

pupil can often be aided in his comprehension of a subject by a written solution or demonstration, but when he explains he should think and express his own thought. If the mind is trained from the beginning in simple, logical forms of thinking, there will be little difficulty in this respect. Pupils will follow these simple thought-forms in all their investigations, and be enabled to originate new solutions and demonstrations.

12. In the lower grades but little attention should be given to definitions. The meaning of each technical term should be clearly understood, but the formal definition of it is of no value to the pupil. In the grammar grades, however, some attention should be paid to defining these terms. Every definition should be derived by illustrations before the idea is formulated into words; but when it is understood and formulated there is no objection to the pupils being required to state it. On the other hand, there is the advantage of the cultivation of the habit of the clear and definite expression of ideas. Great care should be taken, however, to avoid the common error of allowing pupils to repeat words without expressing ideas.

13. Very few, if any, rules need be learned by pupils. Processes are to be learned, but not rules. There should be such an intelligent drill on methods and processes that, in most cases, they will be remembered without any formal statement of them. No one would think of teaching addition, subtraction, multiplication and division by rules. Besides, pupils should be so familiar with principles that, in most cases, they can make their own rules. In a few cases, however, a rule may be fixed in the memory, as in the division of fractions or some short method of working interest. Such cases, however, are very rare, and the motto should be,—principles and processes rather than rules.

14. All the exercises in arithmetic should be as practical in their nature as possible. They should represent

the operations of real life, and not some abstract or fancied view of what these operations might be. In denominate numbers the measures should be applied to the actual uses of the store, the shop, the market, the household, etc. The problems in percentage should not merely illustrate the theoretical principle, but represent the actual business of the street or office. It would be well for the teacher to visit the bank, the insurance office, the tax office, the custom house, etc., and see what the real business transactions are. These forms of business may then be organized in the school-room, and the operations of real life be thus represented. In this way the pupil will obtain a practical knowledge of his arithmetic, and be prepared to step from the school into the business office.

15. Exercises requiring pupils to invent original problems will be found of great interest and value. These original problems may be either oral or written. They are to be assigned to the class for solution and also for the correction of any errors that they may contain. The making of these problems exercises the power of original thought, and at the same time tends to give pupils a clearer idea of the subject than the mere solution of problems already at hand.

16. Special attention should be given to "arithmetical analysis," or Mental Arithmetic, in the grammar grades. This is an exercise of great value for the training of the reasoning powers of the child. Taught in the correct way, as indicated in the following suggestions, it affords the finest discipline to the intellect, training it to habits of attention and logical forms of thought and expression.

The problems should be dictated by the teacher, then reproduced by the pupil, and then analyzed. The restatement by the pupil is regarded as important in insuring a clear conception of the conditions and the requirements of the problem. In order to cultivate attention, the problem should be announced but once, and the class be held

responsible for its repetition. The question should be stated before calling upon the pupil, in order to avoid any order of assignment that allows the class to anticipate whose turn comes next.

The analysis should be given orally, except in cases of review or examination, when it may also be written. This analysis should be simple, concise, and logical. All round-about, awkward, and wordy solutions are to be avoided. The thought should be straightforward and to the point, and the expression simple and explicit. Original solutions, even if they depart from the form preferred, are to be accepted and encouraged.

The problems should be carefully graded and adapted to the advancement of the class. They should at the beginning involve only one or two steps or conditions, and gradually pass to more complicated forms. They should be stated in simple and direct language, so as to be understood by the average pupil. All puzzling inversions of language and all so-called "catch questions," should be carefully avoided in the general exercises. With advanced classes, an occasional exercise with "arithmetical puzzles" may cultivate quickness and expertness of thought, but such exercises should be only occasional.

17. Every pupil leaving the public schools should have a practical knowledge of the elements of geometry. This is presented to the pupils of the Twelfth Grade under the head of Mensuration. The course includes the different geometrical figures and their parts, the area of plane surfaces, the circumference and area of the circle, and the surfaces and contents of the solid bodies. The rules for these measurements are to be derived concretely by illustrations with models, paper forms, blackboard, etc. The proper use of these illustrations will give pupils a very satisfactory idea of the reasons for the different rules. These "concrete demonstrations" will also pave the way

for a much clearer conception of the abstract demonstrations when the pupil is ready to study the science of geometry. There should be abundant practice in the different methods, until they are permanently fixed in the student's understanding and memory. In the practical application of the principles to measuring land, carpeting floors, papering rooms, etc., the teacher should be careful that the problems given represent the actual methods of practical life.

18. The judicious use of a text-book will be found a convenience in teaching arithmetic in the grammar grades. It economises the time of the teacher, presents things more definitely and with less liability of error than when copied from the blackboard, gives opportunity for the pupils to work out certain subjects for themselves, and thus cultivates a spirit of independence and self-reliance. It would seem unfortunate for a pupil of the grammar grades to leave school without knowing how to make use of an arithmetic.

The proper use of a text-book, however, requires as much skill on the part of the teacher as does teaching without a book. There should be no slavish dependence upon the book by either pupil or teacher. Much of the teaching should be independent of the text-book. A judicious selection and omission of the matter in the book should be made, and a large number of exercises should be given in addition to those found in the work used. In fine, the object should be to teach the subject rather than the book.

19. The recitation in written arithmetic requires great skill on the part of the teacher. As many pupils should be sent to the board as can be accommodated, and the rest of the class be required to work on slates or paper at their desks. All the pupils may be assigned the same problems, or different problems may be assigned to different members of the class. When the solution is completed, some one should be called on to explain a problem solved upon

the board, the others listening attentively and noticing any mistakes that may be made, and whether any shorter or better method of solution is possible. At the close of the explanation, questions should be asked by the pupils, corrections made, and suggestions given. The teacher, by appropriate questions, should test the knowledge of the class and lead them to see each step of the solution and the reason for it. Points not understood by any member of the class should be explained, and the effort made to see that every pupil has a clear conception of every part of the lesson.

20. The work on the board should be neat and accurate. No carelessness in writing out the solution should be allowed. The figures should be correctly made, the lines straight and generally parallel with the edge of the board. When the work is written on paper for examination or review, it is recommended that the problem be written out in full, and that the operation and explanation be written alongside of each other. The following problem and its solution will serve as an illustration:—

PROBLEM:—If 25 yards of cloth cost \$156.25, what will be the cost of 36 yards of the same kind of cloth?

<u>Solution.</u>	<u>Operation.</u>	
If 25 yards of cloth cost	25)156.25	(6.25 \$6.25
\$156.25, one yard will cost	150	36
$\frac{1}{25}$ of \$156.25, which is	62	3750
\$6.25; and 36 yards will	50	1875
cost 36 times \$6.25, or	—	—
\$225.00.	125	\$225.00
Answer, \$225.00.	125	

This solution may also be presented in the “analytic form,” as follows:—

If 25 yards of cloth cost \$156.25,

1 yard of cloth will cost $\frac{1}{25}$ of \$156.25=\$6.25.

And 36 yards of cloth will cost \$6.25 $\times$ 36=\$225.00.

The solution of problems that require a simple analysis may be written in another form as follows:—

<u>Problem.</u>	<u>Solution.</u>
A has \$40, which is $\frac{2}{3}$ of B's money, and C has $\frac{3}{4}$ as much money as B; how much money have B and C separately?	If $\frac{2}{3}$ B's = \$40, $\frac{1}{3}$ B's = $\frac{1}{2}$ of \$40 = \$20 $\frac{3}{4}$ B's = \$20 $\times$ 3 = \$60 $\frac{1}{4}$ B's = $\frac{1}{4}$ of \$60 = \$15 $\frac{3}{4}$ B's = \$15 $\times$ 3 = \$45 Hence C's = \$45
Answer, B's \$60; C's \$45.	

21. These forms are merely suggestive of something systematic and definite in written work. Other forms similar to them may be used at the option of the teacher. These forms of writing the work should begin in the ninth grade, and be continued throughout the grammar grades. When the subject admits of it, a diagram neatly drawn to illustrate the problem should accompany the solution.

In the ordinary recitation, it is suggested that either the "analytic solution" or the "operation" be used, and not both by the same pupil. One part of the class may be required to write the operation and another part the solution. Occasionally, once a week or once in two weeks, the solution and operation may both be required written side by side somewhat in the form previously suggested.

22. In conclusion, it is suggested that teachers try to attain a high degree of excellence in teaching arithmetic. Let the aims be to awaken mind, arouse interest, train to habits of industry, develop skill in the use of numbers, and cultivate the power of clear, logical, and independent thinking. Properly taught, arithmetic can be made one of the most interesting and profitable studies of the public schools,

THE COURSE OF INSTRUCTION FOR THE GRAMMAR GRADES.

NINTH GRADE.—*Time, ten months.*

I. *Review of fundamental operations.*

1. Drill in reading and writing numbers.
2. Sight exercises for rapidity and accuracy.
3. Written exercises in fundamental operations.
4. Reasons for the different processes of the fundamental operations.

II. *Divisors and multiples.*

1. Factoring numbers.
2. Greatest common divisor.
 - (a) By factoring.
 - (b) By successive division.
3. Least common multiple.
 - (a) By factoring.
 - (b) By numbers in a line.
4. Exercises in cancellation.
 - (a) Abstract exercises.
 - (b) Concrete problems.
 - (c) Operations with fractions.

III. *Common fractions.*

1. Reduction.
 - (a) Numbers to fractions.
 - (b) Fractions to numbers.
 - (c) To larger and to smaller terms.
 - (d) Compound fractions to simple ones.

2. Addition and subtraction.
3. Multiplication and division.
4. Relation of integers and fractions.
5. Principles of multiplying and dividing the numerator and the denominator.
6. Practical examples in fractions. Use no complex fractions.

IV. *Decimal fractions.*

1. Read and write decimals.
2. Addition and subtraction.
3. Multiplication and division.
4. Reduce common fractions to decimals.
5. Reduce decimals to common fractions.
6. Practical exercises in decimals.
7. Practice in making and computing bills and accounts.

V. *Denominate numbers.*

1. Review tables of previous grades.
2. English money and circular measure.
3. Exercises in reduction, addition, subtraction, etc.
4. Practical exercises in the measures. Use not more than four denominations. No denominate fractions.

VI. *Arithmetical analysis.*

1. Pass from a number to a number.
2. Pass from a fraction to a fraction.
3. Simple problems involving the relation of numbers.
4. Analysis of the following cases of fractions:—
 - (a) Mixed number to a fraction.
 - (b) Fraction to whole or mixed number.

- (c) To higher terms.
- (d) To lower terms.
- (e) Compound fractions to simple ones.
- 5. Simple problems in denominate numbers.
- 6. Concrete problems involving the relation of integers and fractions.

TENTH GRADE.—*Time, ten months.*

I. *Review of previous grades.*

- 1. Notation and numeration.
- 2. Fundamental rules.
- 3. Divisors and multiples.
- 4. Bills and accounts.
- 5. Fractions and decimals. No complex fractions.
- 6. Exercises, oral and written, for facility and accuracy.
- 7. Reasons for these processes.

II. *Denominate numbers.*

- 1. Review previous measures.
- 2. Troy weight and apothecaries weight.
- 3. Exercises in these measures.
- 4. Exercises in denominate fractions and decimals.

III. *Percentage, without time.*

- 1. Concrete problems.
- 2. Profit and loss.
- 3. Commission.
- 4. Stocks and dividends.
- 5. Brokerage.

NOTE.—Make the pupils familiar with checks, bonds, stocks, par value, premium, discount.

IV. *Arithmetical analysis.*

1. Analyze all the cases of fractions.
2. Suitable exercises in denominate numbers.
3. Simple problems in "proportional parts."
4. Percentage and its applications.
5. Interesting problems suited to the grade.

ELEVENTH GRADE.—*Time, ten months.*I. *Review of previous grades.*

1. Drill exercises (oral and written) for quickness and accuracy.
2. Review notation and numeration, fundamental rules, fractions, decimals and denominate numbers, percentage, etc.
3. Exercises in longitude and time. Simple forms of complex fractions.
4. Explanation of the reason of these processes.

II. *Business forms.*

1. Simple commercial transactions.
2. Bills, accounts, receipts, checks, notes, etc.
3. Terms :—*debtor, creditor, debt, credits, account, account current*, etc.

III. *Percentage, with time.*

1. Simple interest.
2. Interest on notes.
3. Banking and discount.
4. Compound interest.
5. Review the work of the previous grade.

NOTE.—Drill the pupils on notes, their indorsement and maturity, days of grace, protest, etc. In compound interest give only simple problems to illustrate the principle.

IV. *Proportion and partnership.*

1. Simple proportion.
2. Simple partnership.

NOTE:—Solve the problems in simple proportion by the method of proportion and also by analysis. Solve the problems in partnership by analysis only.

V. *Arithmetical analysis.*

1. Review fractions.
2. Exercises in “proportional parts.”
3. Percentage and simple interest.
4. Interesting problems suited to the grade.

TWELFTH GRADE.—*Time, ten months.*

I. *A general review.*

1. Drill exercises, for facility and accuracy.
2. The method of operation in any previous subject.
3. Reasons for any process in any previous subject.
4. Definition and use of the terms presented.

II. *Percentage and its applications.*

- | | |
|---|----------------------|
| 1. Taxes | 4. Annual interest. |
| 2. Customs. | 5. Insurance. |
| 3. Trade discounts. | 6. Partial payments. |
| 7. Review of the work of the previous grades. | |

NOTE.—Drill thoroughly on business papers and methods. In partial payments, use only the United States rule. Give no problems requiring extended operations.

III. *Proportion and partnership.*

1. Compound proportion.
2. Compound partnership.

NOTE.—Let the problems be simple and solve them by analysis.

IV. *Involution and evolution.*

1. The powers of numbers.
2. Square root and its applications.
3. The right triangle.

V. *Mensuration of surfaces and solids.*

1. Geometrical figures, their names and parts.
2. Surfaces: rectangle, parallelogram, triangle, trapezoid, trapezium, and circle.
3. Solids: prism, parallelopiped, pyramid, cylinder, cone, and sphere.

NOTE.—Find the dimensions and the area of the surfaces, and the surface and the contents of the solids.

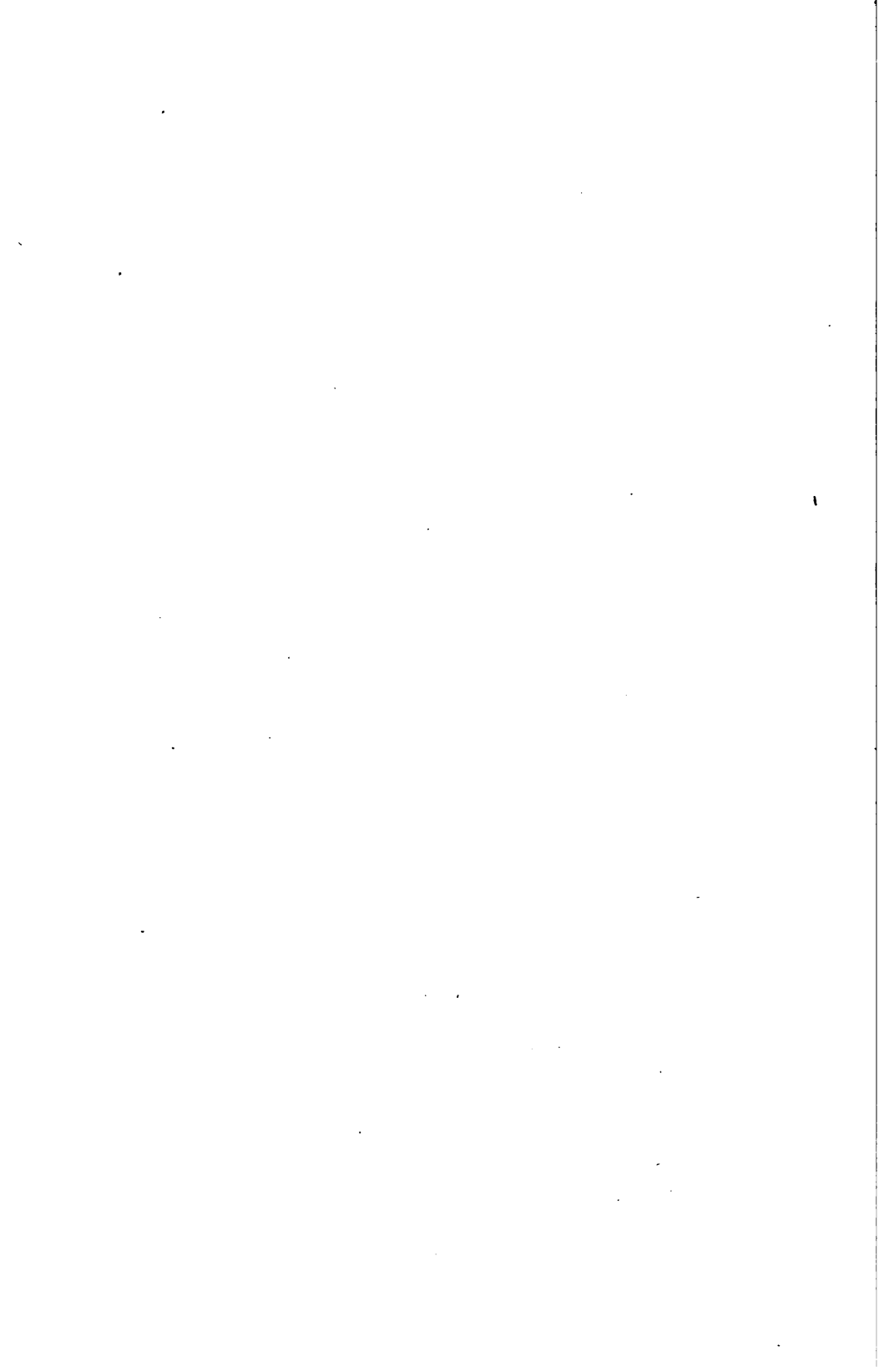
VI. *Application of mensuration to practical problems.*

1. Measurement of land.
 2. Plastering and paving.
 3. Carpeting and papering.
 4. Capacity of cisterns, bins, etc.
- NOTE.—Omit the denominations roods, chains, and links.

VII. *Arithmetical analysis.*

1. Review the analysis of previous grades.
2. Interesting problems suited to the grade.

NOTE.—All necessary terms in this and in all preceding grades to be learned as they are needed.



THE
COURSE OF INSTRUCTION
IN
MODELING

FOR THE
PRIMARY AND SECONDARY SCHOOLS OF
PHILADELPHIA

PREPARED BY
EDWARD BROOKS

Superintendent of Public Schools, Philadelphia, Pa.



BURK & McFETRIDGE, PRINTERS, 306-308 CHESTNUT ST.

1892



Philadelphia Board of
public education

THE
COURSE OF INSTRUCTION
IN
MODELING

FOR THE
PRIMARY AND SECONDARY SCHOOLS OF
PHILADELPHIA

PREPARED BY
EDWARD BROOKS
Superintendent of Public Schools, Philadelphia, Pa.

PHILADELPHIA:
BURK & MCFETRIDGE, PRINTERS, 306-308 CHESTNUT ST.

1892



TO TEACHERS OF PRIMARY AND SECOND- ARY SCHOOLS.

The Board of Public Education, at its meeting held in September, 1892, authorized the Superintendent of Public Schools, in connection with the Committee on Revision of Studies, to introduce into the primary and the secondary schools, such forms of elementary manual training as, in their judgment, may be deemed advisable. In accordance with this action, the following course in modeling has been prepared for use in the primary and the secondary schools of this city.

Teachers are requested to introduce the work indicated into their respective schools at as early a date as practicable. Since the character of the work is new to most of the schools, it will be necessary in the higher grades to begin and complete the course prescribed for the lower grades before the work assigned to these higher grades can be taken up.

It is understood that this course can not be fully accomplished in a single term, but it is expected that in another year the work of each grade will be carried out completely—or, at least very nearly so.

It will also be borne in mind that some teachers may not, at present, feel prepared to meet all the requirements of the course. Such teachers are requested to report to the Superintendent in order that arrangements may be made for a series of lessons to assist them in qualifying themselves to give the instruction specified in the course for the several grades.

Attention is also called to the fact that the clay-work of a year in the kindergarten embraces the modeling of the sphere, the cube and the cylinder, with simple objects derived from each of these type forms, such as grapes, apples, potatoes, melons, boxes, tea-chests, etc., with exercises also in inventive modeling. When kindergarten children in numbers sufficient to form a class enter the lowest primary grade, the practice they will have had in modeling should make it possible for that class to be carried further in the clay-work than they could otherwise go—at least in the number of objects modeled during the term.

GENERAL SUGGESTIONS.

The work in modeling for every grade will consist of these principal divisions of the subject: I. Modeling the Type Forms; II. Modeling of common objects, natural and artificial, similar to the Type Forms; III. Decorative work in modeling. After the second year, Modeling in Relief is introduced and carried along with modeling in the solid, or "the round."

The modeling of every new type form, or common object based on it, is to be preceded by an observation lesson on the form as a whole, and on the relation of each object to its type. The entire lesson is to be conducted according to the following plan:—

1. Lesson on the Type Forms.
 - (a). Handle the forms and observe their characteristics.
 - (b). Contrast the forms with one another, and note their differences.
2. Expressing by language ideas respecting forms.
 - (a). Names of the different forms.
 - (b). Names of some of the elements of the forms.
 - (c). Names of some of the properties of the forms.
3. Modeling the forms.
 - (a). Making in clay the forms.
 - (b). Comparing the clay models with the type forms.
 - (c). Language to express ideas and thoughts.
4. Inventive work in modeling forms.

This outline will be given in full for the exercises in the first grade that teachers may see clearly its application, and it will be understood in each of the subsequent grades though not formally stated in the outline of the course for the grade.

In connection with each lesson the fancy and imagination of the pupil may be appealed to, to prompt him to model or invent some form other than that which has been studied, but which is within the limits of the type form for the lesson.

Manual Training.

CLAY MODELING.

First Year.—FIRST GRADE.—*Time, five months.*

I. THE TYPE FORMS.

1. The Forms to be used :—

(a). The Sphere. (b). The Cube. (c). The Cylinder.

2. Lessons on the Forms.

(a). Handle the forms and observe their characteristics.

(b). Contrast the forms with one another and note their differences.

(c). Place the forms in different relative positions.

3. Language in respect to the Forms.

(a). Names of the different forms.

(b). Names of some of the elements of the forms.

(c). Words expressing the relative position of the forms.

4. Modeling the Type Forms.

(a). Making the sphere, the cube, the cylinder.

(b). Comparing the clay models with the type forms.

(c). Language to express ideas and thoughts.

5. Inventive work in modeling Forms.

NOTE.—The teacher will ask questions about the forms, requiring pupils to use the names of the forms, names of their school-mates, and the pronouns I, he, she, and it, in sentences.

II. COMMON OBJECTS (similar to the type forms).

1. List of objects to be modeled :—

(a). Objects similar to the sphere :—Ball, apple, orange.

(b). Objects similar to the cube :—Box, lump of cut loaf sugar.

(c). Objects similar to a cylinder :—Muff, round box.

2. Lessons on the objects.

(a). Handle the objects and observe their characteristics.

(b). Compare the objects with the type forms.

(c). Language to express ideas about the objects.

3. Modeling the objects.

(a). Making the objects in clay.

(b). Comparing the clay models with the objects.

(c). Language to express ideas and thoughts.

4. Inventive work in modeling common objects.

NOTE.—Require pupils to use the names of the objects and the pronouns I, he, she, and it, in sentences.

III. DECORATIVE WORK.

1. Work with square Tablets.

(a). Modeling the tablets.

(b). Impressing the faces of the type forms on the tablets.

(c). Drawing on the tablets (circle, square, etc.).

2. Inventive work on Tablets.

- (a). Modeling square tablets of different sizes.
- (b). Drawing simple outlines on the tablets.

NOTES.—1. In impressing the type forms on tablets, have pupils try to form a variety of pleasing combinations. So also in the inventive drawing on tablets.

2. The teacher will exercise judgment in properly combining the inventive work with the other parts of the course.

First Year.—SECOND GRADE.—*Time, five months.*

I. THE TYPE FORMS.

1. The forms to be used :—

- (a). The hemisphere.
- (b). The square prism.
- (c). The right-angled triangular prism.

2. Modeling the type forms.

- (a). Making hemisphere, square prism, etc.
- (b). Comparing clay models with type forms.
- (c). Language to express ideas and thoughts.

3. Inventive work in modeling forms.

NOTE.—The names of the forms, school-mates, and the pronouns I, he, she, and it, are to be used in sentences.

II. COMMON OBJECTS (similar to the type forms).

1. List of objects to be modeled :—

- (a). Similar to the sphere :—Peach, gourd.
- (b). Similar to the cube :—Inkstand, square can.
- (c). Similar to the cylinder :—cheese, round can.
- (d). Similar to the hemisphere :—Half an apple, pin-cushion.
- (e). Similar to the square prism :—Box.

2. Modeling the objects.

- (a). Making the objects in clay.
- (b). Comparing clay models with the objects.
- (c). Language to express ideas and thoughts.

3. Inventive work in modeling common objects.

NOTE.—In addition to names of forms, parts, etc., have children use words expressing what the objects will do, as roll, slide, stand, etc.

III. DECORATIVE WORK.

1. Work with square tablets.

- (a). Modeling the tablets.
- (b). Impressing the faces of the type forms on the tablets.
- (c). Drawing simple outlines on the tablets.

2. Inventive work with tablets.

- (a). Modeling tablets of different forms.
- (b). Drawing outlines on tablets.

NOTES.—1. Review the work of the previous grade.

2. In impressing the faces of the type forms on the tablets, have pupils try to form a variety of pleasing combinations. So also in the inventive drawing on the tablets. Endeavor to teach simple repetition and a variation.

Second Year.—THIRD GRADE.—*Time, five months.*

I. THE TYPE FORMS.

1. The forms to be used:—

- (a). The ellipsoid.
- (b). The ovoid.
- (c). The equiangular triangular prism.

2. Modeling the type forms.

- (a). Making the forms named above.
- (b). Comparing clay models with the type forms.
- (c). Language to express ideas and thoughts.

3. Inventive work in modeling forms.

II. COMMON OBJECTS (similar to the type forms).

1. List of objects to be modeled :—
 - (a). Similar to the sphere :—Round radish, melon.
 - (b). Similar to the cube :—Toy bank, toy trunk.
 - (c). Similar to the cylinder :—Drum, jar.
 - (d). Similar to the hemisphere :—Cup, saucer.
 - (e). Similar to the square prism :—Brick, double steps.
 - (f). Similar to the ellipsoid :—Lemon, plum.
 - (g). Similar to the ovoid :—Egg, chick.
2. Modeling the objects.
 - (a). Making the objects in clay.
 - (b). Comparing clay models with the objects.
 - (c). Language to express ideas and thoughts.
3. Inventive work in modeling common objects.

III. DECORATIVE WORK.

1. Modeling square and circular tablets.
 - (a). Modeling the tablets.
 - (b). Impressing the faces of the type forms on the tablets.
 - (c). Drawing on the tablets.
 - (d). Modeling square and circular tablets on the faces of other tablets.
2. Inventive work with tablets.
 - (a). Modeling tablets of different forms.
 - (b). Drawing outlines on the tablets.

NOTES—1. Review the work of the previous grades.

2. Lead pupils to a free and spontaneous expression of their ideas and thoughts. Call in play the imagination of children in the conception of ideal forms.

3. In impressing the type forms upon the tablets have pupils make impressed borders of the square, both upright and at 45 degrees, combined with the circle and ellipse. In inventive work lead the pupils to form a variety of pleasing combinations.

Second Year.—FOURTH GRADE.—Time, five months.

I. THE TYPE FORMS.

1. The forms to be used :—
 - (a). The cone.
 - (b). The square pyramid.
 - (c). The vase-form.
2. Modeling the type forms.
 - (a). Making the forms in clay.
 - (b). Comparing clay models with the type forms.
 - (c). Language to express ideas and thoughts.
3. Inventive work in modeling forms.

III. COMMON OBJECTS (similar to type forms).

1. List of objects to be modeled :—
 - (a). Similar to the sphere :—Tomato, turnip, squash.
 - (b). Similar to the cube :—Paper weight, footstool.
 - (c). Similar to the cylinder :—Banana, fire cracker.
 - (d). Similar to the hemisphere :—Half orange, bee-hive, basket.
 - (e). Similar to the square prism ;—Eraser.
 - (f). Similar to the ellipsoid :—Melon, potato.
 - (g). Similar to the ovoid :—Sweet potato, mouse.
 - (h). Similar to the cone :—Top, carrot.
2. Modeling the objects
 - (a). Making the objects in clay.
 - (b). Comparing clay models with the objects.
 - (c). Language to express ideas about the objects.
3. Inventive work in modeling objects.

III. DECORATIVE WORK.

1. Modeling square and circular tablets.
 - (a). Making the tablets.
 - (b). Impressing the faces of type forms on the tablets.
 - (c). Drawing the faces of the type forms on the tablets.
2. Inventive work with tablets.
 - (a). Modeling tablets of different forms.
 - (b). Drawing outlines on tablets.
 - (c). Arranging ideal forms on tablets.

NOTES.—1. Review, as may be found necessary, the work of the previous grades.

2. In decorative work, continue the exercise of impressing the type forms on the tablets, making borders with these forms in repetition and alternation.

3. In inventive work, the pupils should be led to form a variety of pleasing combinations, thus giving culture to the art-sense.

Third Year.—FIFTH GRADE.—*Time, five months.*

I. TYPE FORMS MODIFIED.

1. The forms to be modeled :—
 - (a). The sphere and cube bisected.
 - (b). The sphere and cube quadrisected.
 - (c). The cone truncated.
 - (d). The cone bisected and truncated.

II. OBJECTS TO BE MODELED.

1. Common objects :—
 - (a). Similar to sphere :—Sugar bowl, round potato.
 - (b). Similar to cube :—Dog-house.
 - (c). Similar to cylinder :—Bottle, spool.
 - (d). Similar to hemisphere :—Dish with handles, half-peach with stone.
 - (e). Similar to square prism :—Book, bench.
 - (f). Similar to ellipsoid :—Olive, gourd.
 - (g). Similar to ovoid :—Acorn, gosling.
 - (h). Similar to cone :—Oyster-plant, ink-bottle.

2. Leaf forms.

- (a). From nature:—The lilac, morning glory.
- (b). From models:—The lilac, morning glory.

3. Animal forms.

- (a). From nature:—Chick, duckling, mouse.
- (b). From models:—Chick, duckling, mouse.

NOTE.—The leaf forms are to be modeled on tablets.

III. DECORATIVE WORK.

1. Forms in relief:—

- (a). Geometric forms in relief:—Circle, square, triangle.
- (b). Rosettes in relief:—The type forms modified.
- (c). Leaves in relief:—Lilac, morning glory, ivy.

2. Inventive work:—

- (a). Modifying the type forms.
- (b). Ideal objects selected by the pupils.
- (c). Ideal leaf and animal forms.

NOTES.—1. Borders:—Continue to make borders by combining the type forms and their modifications in repetition and alternation.

2. Rosettes:—In these the centre may be composed of the sphere and hemisphere modified or indented. The cone and sphere divided or modified and repeated may be used to form the radiating part.

3. The leaves in relief may be single leaves on the tablet or united into designs forming a radiation about a centre. The "models" for leaves should be conventional.

Third Year.—SIXTH GRADE.—*Time, five months.*

I. TYPE FORMS MODIFIED.

1. The forms to be modeled:—

- (a). Sphere and cube bisected and quadrisected.
- (b). Cone and square pyramid bisected and truncated.

II. OBJECTS TO BE MODELED.

1. Common objects :—

(a). Similar to the sphere :—Globe for gold-fish, bunch of cherries. (b). Similar to the cylinder :—Pea-pod, rolling-pin. (c). Similar to the hemisphere :—Cap, bowl with band. (d). Similar to the square prism :—Chest, trunk, double steps. (e). Similar to the ellipsoid :—Onion, lime, shellbark. (f). Similar to the ovoid :—Bird, pig. (g). Similar to the cone :—Radish, parsnip.

2. Leaf forms.

(a). From nature :—Morning glory, poplar, ivy, maple.

(b). From models :—Morning glory, poplar, ivy, maple.

3. Animal forms.

(a). From nature :—Guinea pig, cat, dog, fish.

(b). From models :—Guinea pig, cat, dog, fish.

III. DECORATIVE WORK.

1. Forms in relief :—

(a). Geometric forms in relief :—Oblong, ellipses, oval.

(b). Rosettes in relief :—The type forms modified.

(c). Leaves in relief :—Morning glory, poplar, etc.

2. Inventive work :—

(a). Modifying the type forms.

(b). Ideal objects selected by the pupils.

(c). Ideal leaf and animal forms.

Notes.—1. Review the work of previous grades so far as may be necessary. The leaf forms are to be modeled on tablets.

2. The rosettes are to be composed of the ellipsoid and the semi-ellipsoid, compressed and indented, and combined with the sphere and hemisphere. Also of the square pyramid divided and combined with the hemisphere.

3. The leaves in relief may be single leaves on the tablets, or united into designs forming a radiation about a centre.

Fourth Year.—SEVENTH GRADE.—*Time, five months.*

I. TYPE FORMS MODIFIED.

1. The ellipsoid bisected and quadrisected.
2. The ovoid bisected and quadrisected.
3. The triangular prism divided by planes parallel to the base.

II. OBJECTS TO BE MODELED.

1. Common objects:—

(a). Similar to the sphere:—Onion, bunch of grapes. (b). Similar to the cylinder:—Napkin in ring, bean-pod. (c). Similar to the hemisphere:—Hat, raspberry. (d). Similar to the square prism:—Curbstone, toy-house. (e). Similar to the ellipsoid:—Cucumber, pecan-nut. (f). Similar to the ovoid:—Pear, strawberry. (g). Similar to the cone:—Pinecone, beet.

2. Leaf forms.

- (a). From nature:—Violet, chestnut, maple.
 (b). From models:—Violet, chestnut, maple.

3. Animal forms.

- (a). From nature:—Rabbit, squirrel, pig, pigeon.
 (b). From models:—Rabbit, squirrel, pig, pigeon.

III. DECORATIVE WORK.

1. Forms in relief:—

- (a). Geometric forms:—Hemisphere, semi-ellipsoid.
 (b). Rosettes in relief:—The type forms modified.
 (c). Leaves in relief:—Maple, chestnut, oxalis.
 (d). Animals in relief:—Fish, chick.

2. Inventive work:—

- (a). Modifying the type forms.
- (b). Ideal objects selected by the pupils.
- (c). Ideal leaf and animal forms.

NOTES.—1. Review the work of previous grades so far as may be necessary. The leaf forms are to be modeled on tablets.

2. The rosettes are to be composed of the ovoid and semi-ovoid combined with the modifications of the type forms mentioned in the fifth and sixth grades.

3. The leaves in relief may be single leaves on the tablet, or in repetition forming a border, or united into designs forming a radiation about a centre.

Fourth Year.—EIGHTH GRADE.—*Time, five months.*

I. TYPE FORMS MODIFIED.

- 1. Square prism divided vertically in various ways.
- 2. Square prism divided horizontally.
- 3. Cylinder divided vertically and horizontally.
- 4. Modifications of the vase-form.

II. OBJECTS TO BE MODELED.

1. Common objects:—

(a). Similar to sphere:—English walnut, basket of fruit. (b). Similar to the cylinder:—Vase, ear of corn. (c). Similar to the hemisphere:—Tortoise, mushroom. (d). Similar to the square prism:—A cross, triple steps. (e). Similar to the ellipsoid:—Cantaloupe, pea-nut. (f). Similar to the ovoid:—Egg-plant, vase. (g). Similar to the cone:—Pear, rutabaga.

2. Leaf and flower forms.

- (a). Leaves:—Violet, oak, chestnut, maple.
- (b). Flowers:—Rose bud, calla lily, tulip poplar.

3. Animal forms.

- (a). Birds:—Hen, sparrow, goose.
- (b). Quadrupeds:—Rabbit, sheep.

III. DECORATIVE WORK.

1. Forms in relief:—

- (a). Geometric forms:—Hemisphere, semi-ovoid, semi-ellipsoid.
- (b). Rosettes in relief:—Type forms modified.
- (c). Leaves in relief:—Violet, oak, chestnut, maple.
- (d). Flower forms in relief:—Wild-rose, dog-wood blossom, daisy, tulip poplar.
- (e). Animal forms in relief:—Duck, pig, human face.

2. Inventive work:—

- (a). Modifying the type forms.
- (b). Ideal objects selected by the pupils.
- (c). Ideal leaf and animal forms.

NOTES.—1. Review the work of previous grades so far as may be necessary. The leaf forms are to be modeled on tablets.

2. In the type forms modified, the square prism is to be divided into square prisms, right-angled triangular prisms, square plinths, and square tablets. The cylinder is to be divided, forming oblong faces, semi-circles, quarter-circles, circular tablets, and circular plinths.

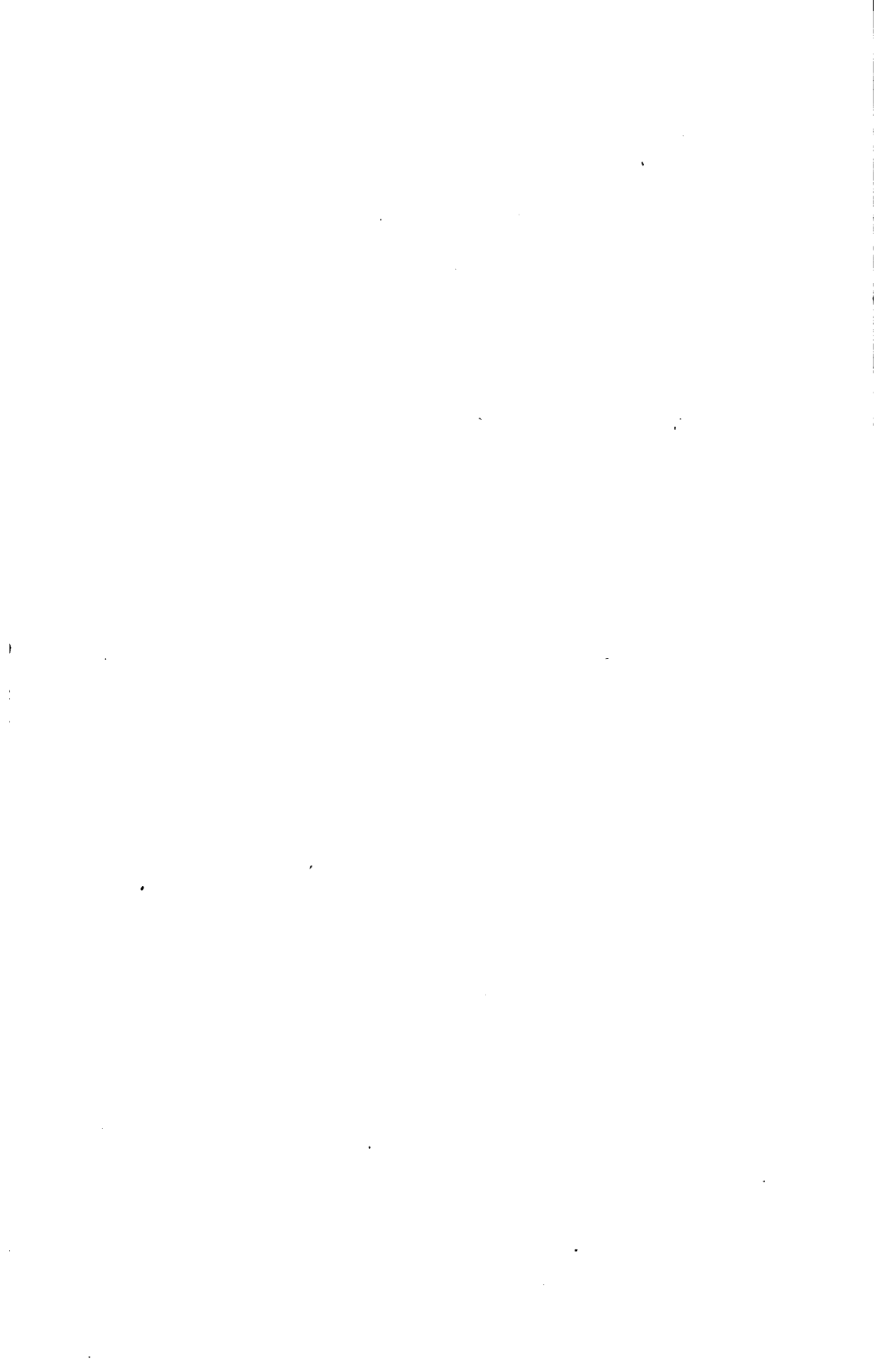
3. In respect to rosettes, see note under the seventh grade.

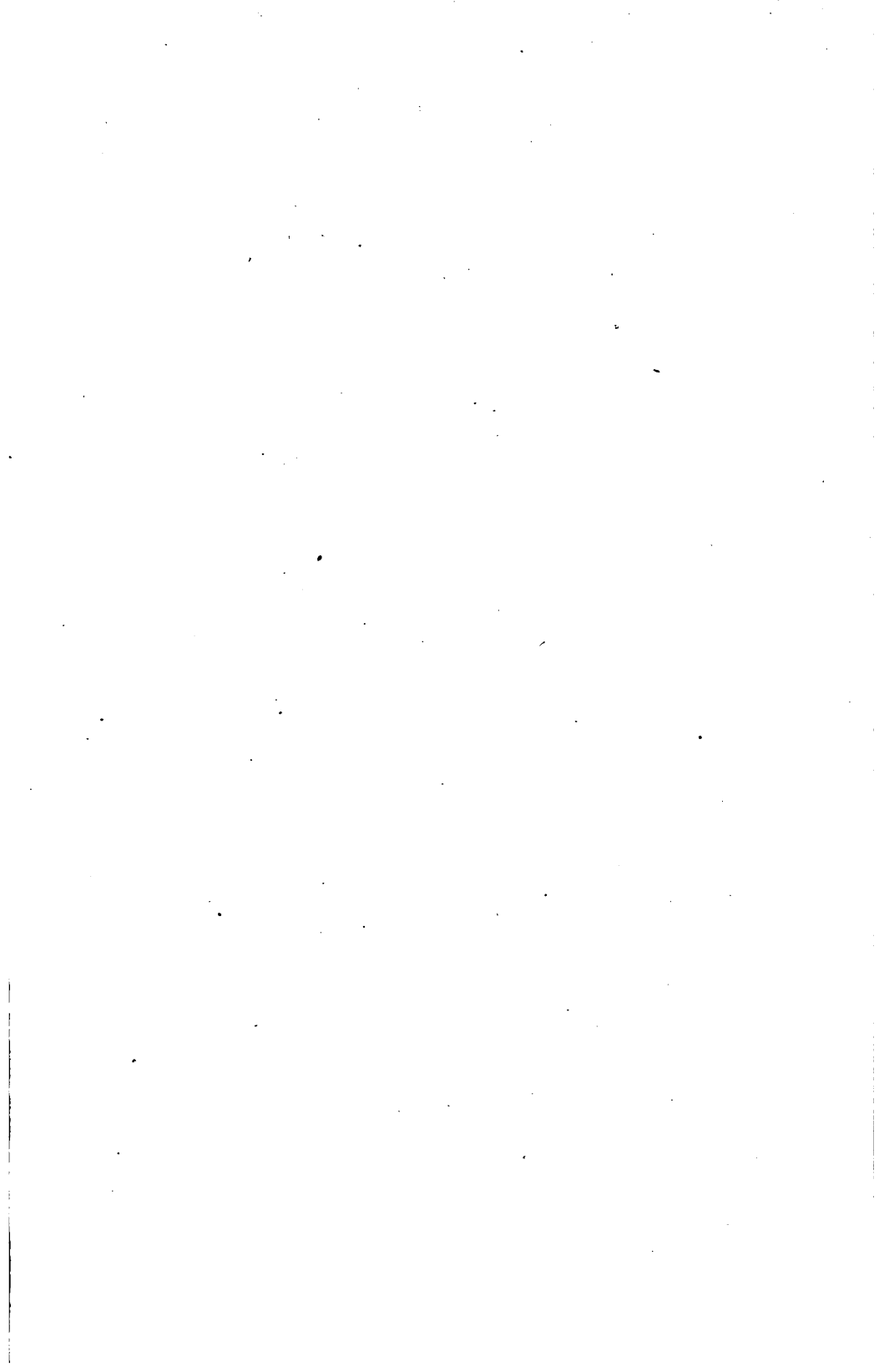
ADDITIONAL EXERCISES.

In addition to the graded work presented for the primary grades, the following list of exercises is also given, from which teachers may make such selections as they think proper:—

Groups of balls, rings, arches, balls on tablets, double link, triple link, shells, bird's-nest, canoe, frog, shoe, shoe last, etc.







THIS BOOK IS DUE ON THE LAST DATE
STAMPED BELOW

AN INITIAL FINE OF 25 CENTS
WILL BE ASSESSED FOR FAILURE TO RETURN
THIS BOOK ON THE DATE DUE. THE PENALTY
WILL INCREASE TO 50 CENTS ON THE FOURTH
DAY AND TO \$1.00 ON THE SEVENTH DAY
OVERDUE.

FEB 15 1933

211115688

FEB 4 1939

JUL 7 1956 LU

RETURNED TO

DEC 1 1972

JUN 12 1938

AN AHC

APR 22 1940

SEP 9 1940

MAY 18 1945

50071

LEWIS

6.1

UNIVERSITY OF CALIFORNIA LIBRARY

